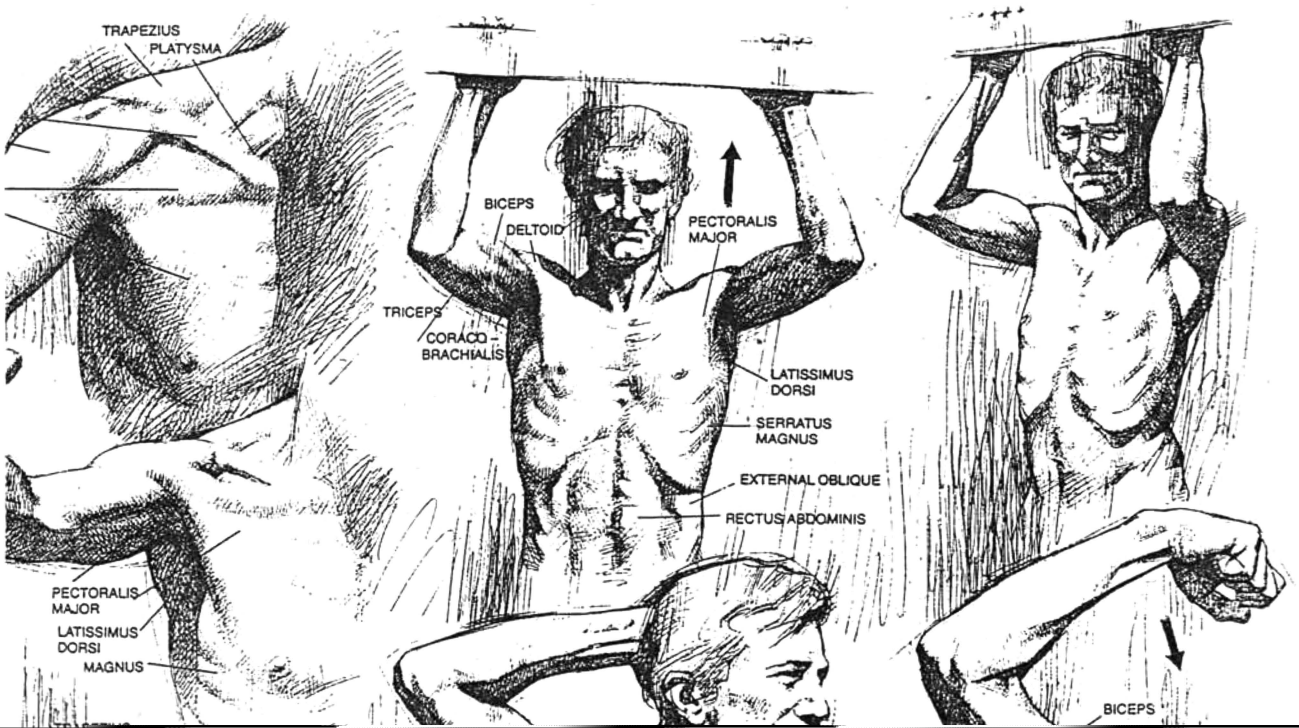
DRAWING HUMAN ANATOMY



NOTES ON THE HUMAN BODY

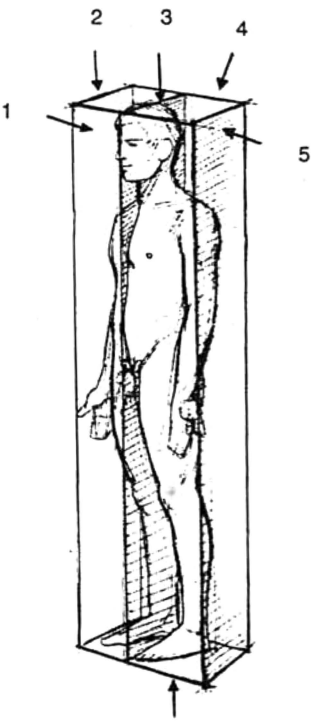
The complex structure of the human organism is divided into several systems or groups of organs related to the same function.

There are the digestive, the respiratory, the cardiocirculatory, the endocrine and the nervous systems and others, each playing its own part in the functions of the human body. Familiarity with these would be helpful and is therefore recommended if one wishes to make a thorough scholarly investigation but, when applied to life drawing, the most interesting apparatus of the human body is the system of motion (the locomotor apparatus). Here we aim to analyse the apparatus of the skeletal, the muscular and the articular systems, as applied to the functions of supporting and protecting the internal organs and of movement. Hence, the system of motion will be the only one to be discussed here.

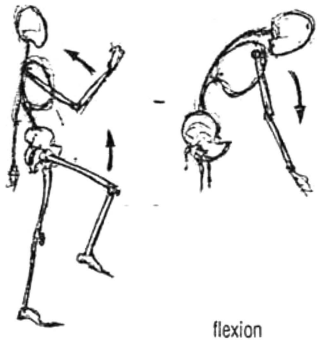
It must be remembered, however, that outer bodily forms are determined by bony and muscular conformations and behaviour (as well as by the integumental apparatus – important for individual morphological characteristics *in vivo*), and are obviously influenced by all the other systems, with extensive reciprocal connections.

The human body is subdivided into various parts (called, in life drawing, masses): the head, the neck, the trunk (divided again into the thorax or chest and abdomen or belly), the limbs (divided equally and symmetrically into the upper and lower limbs). For convenience and simplification of study, each of these bodily parts has been subdivided into superficial parts.

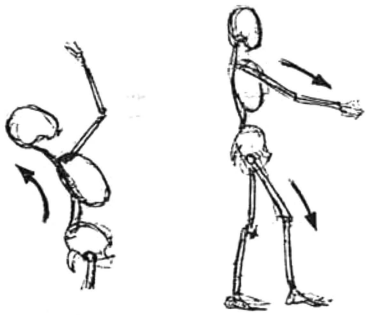
Those relating to the motion system were the first to be closely studied by the great artists of the fifteenth and sixteenth centuries, in collaboration with learned men of science, so laying the basis of modern anatomy. From the appearance of the works of Vesalio (1543) the following order of description (especially relating to the skeletal and muscular systems) is used to this day, being demonstrably the only rationally possible way (based on topographical and functional criteria) to learn the relevant terminology and get a clear vision of the human body.



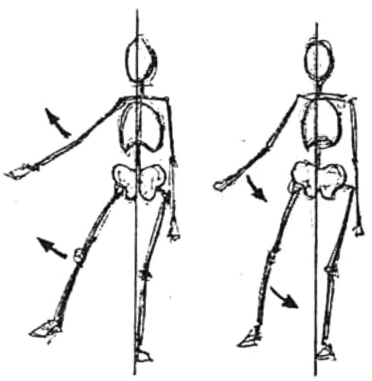
Planes of reference
1 anterior
2 lateral (right)
3 medial
4 posterior
5 lateral (left)
6 inferior



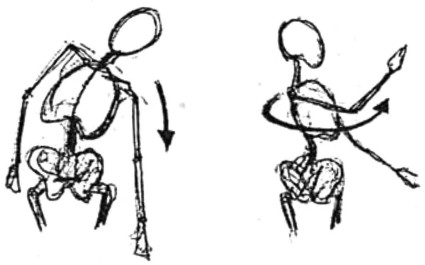
flexion



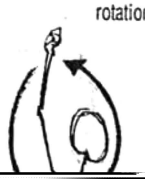
extension



abduction adduction



lateral flexion rotation



Terms for body positions

For the description of positions of structures the body is assumed to be that of a normal adult, standing upright, with arms (upper limbs) by the side, and the palms of the hands facing forwards, with the heels together and the great toes slightly apart. This is called the 'anatomical position' (it is also that of a corpse lying supine on its back, on a dissecting-room table).

- Imagine the body in a parallelepiped. To describe the position of the six parallelograms bounding the body, we list the imaginary planes:
  anterior (or ventral, frontal, palmar)
  posterior (or dorsal)
  right (right side of the body)
  left (left side of the body)
  superior (or coronal, cranial, rostral)
  inferior (or plantar, caudal).
- Consider the median plane of the paralleliped. This imaginary, vertical, longitudinal line runs through the middle of the body from front to back (anterior–posterior), dividing it into symmetrical left and right halves:
  medial: nearer the median plane
  lateral: further from the median plane.
- Referring to interior organs (cavitaries), the terms used are: external (superficial) and internal (cavitary); referring to membranes: parietal and visceral.
- In reference to the limbs the preferred terms are:
  proximal and distal: indicating a part of the body or an organ which is nearer to (proximal) or further from (distal) the root of the structure or the centre of the body
  radial (lateral, outer) and ulnar (medial, inner) in the upper limb
  fibular (lateral) and tibial (medial) in the lower limb
  sagittal: certain front-to-back planes parallel to the median plane transversal: certain horizontal planes
  ventral (sometimes used instead of anterior): the part towards which some limbs (forearm, finger, leg) bend
  dorsal: those parts opposite the ventral.

Terms for movement

The following terms are used to describe action, which comes from articulation of parts of the body:

flexion: this is the turning movement of the sagittal (front-to-back) plane towards the anterior plane
extension: the opposite movement, directed towards the posterior (nearer the back) plane.

- Referring to the limbs, therefore, flexion describes an action that moves the limb forwards and causes it to bend; extension means the movement that stretches the limb, lengthening it and bending it backwards.
  abduction: drawing away from the median line (sideways from the centre)
  adduction: drawing towards the median line (always on the frontal plane), moving the arm or leg towards the body.

NOTES ON MOVEMENT

The articulations that establish the inter-relationships of various bones are either simple contiguous connections (immobile), or ones that govern, in varying degrees, movements between the different bones (mobile and semi-mobile).

Broadly speaking, the joints permit two kinds of movement: axial (sliding and rotating) and angular (flexion, extension, abduction, adduction, circumlocation). Often the complete movement is achieved through the summation, sometimes very complex, of different articular movements,

Knowledge of articular structure and dynamics (at least of the principal mechanisms) is important in the formation of an artist who draws from life. As stated earlier, while the working of joints is seldom apparent externally, an understanding of the limits of their dynamic range is essential to a coherent artistic rendering of bodily movement.

The number of joints which together integrate the bones into a single structure is very large, but they can be broadly grouped into two categories, according to their functional characteristics:

Synarthrosis In character, very restrictive of movement. The joining of two articular surfaces of contiguous bones is achieved by the interposition of connective or cartilaginous tissue capable of differing degrees of deformability which, while permitting minimal changes of position, establishes a structure of continuity between the bony segments. Particular types of synarthrosis are: dentate or squamous sutures, and symphysis.

Diarthrosis This is the typical mobile articulation admitting free movement between two or more adjacent bones. The touching surfaces are covered by cartilages and, between these, there is a very small space (joint cavity) containing synovium, a liquid that reduces friction. The osseous segments are maintained in contact by a fibrous sleeve (articular capsule), reinforced by fibrous bands of varying size (articular ligaments). These mechanisms prevent separation of the articular extremities and limit the maximum extent of movement in the joint.

The category of diarthrosis contains a classification of the various types of joint based on the morphological characteristics of the articulating bone ends, and on the extent of the movement allowed:

arthrosis: this occurs in short bones in which the flat surfaces are in contact with the cartilaginous covering and retained within a sleeve inserted into the edge of the cartilage. It allows only axial movement (sliding, rotating): articulation of the carpus and tarsus;

condyloarthrosis: the smooth, articulating, ovoidal ends of a bone, one concave, the other convex (condyle). Movement is allowed on two angular planes, but not rotation;

enarthrosis: a ball-and-socket joint. This type of articulation allows all angular and rotating movements; their range is restricted only by the joint capsule and ligaments: articulation of the shoulder, hip;

ginglymus: hinge joints; movement is limited to one plane; the bony articulating condyles in contact have superficial cylindroids, one of which is convex, the other concave. Movement may be either rotating (sideways ginglymus) or flexion and extension (angular ginglymus).

Finally, there are the articulating groups, in which various bony heads are involved in a single action and are united by the same capsule: examples are the articulation of the elbow and of the knee.

synarthrosis

symphysis (pelvis)

sutural (cranium)

diarthrosis

arthrosis (tarsus)

condyloarthrosis
(wrist)

enarthrosis (hip)

ginglymus (elbow)

NOTES ON MUSCLE STRUCTURE

The muscles relating to the locomotor or motion system belong to the category of voluntary muscles, that is, subordinate to the dominion of the will and, therefore, of the central nervous system. (The other group, the involuntary muscles, consist of those mainly visceral muscles whose movements of contraction or relaxation do not depend on any voluntary action and are included in the study of the autonomous system.) Therefore, the muscles which we discuss here are the active organs of movement of the human body, subject to the will. They are inserted into the bony segments through the tendons and, when contracting (therefore, shortening), determine the displacement within the limits allowed by the relative movement.

The branch of normal human anatomical study that covers the muscular apparatus and its auxiliary formation (myology) is important for the artist who wants to understand and, therefore, be capable of representing exactly (even with complete freedom of expression) the human body in its infinite static and dynamic poses. The muscles form, below the teguments – fatty layers, skin and related structures – the fleshy part of the body which is directly visible to the eye. Mere superficial observation of the nude is not enough for the education of a serious artist as the interpretation of every movement requires both a knowledge of the surface features and function of the affected muscular organs and the examination of their modifications and antagonistic or synergistic inter-relations. The following paragraphs give a brief summary of some of the structural characteristics of muscles, showing how they function.

Muscle structure and form

The contractile part is fleshy and reddish in colour. This is very prominent when in contraction, but even when the muscle is relaxed there is a pre-contractile state (muscle tone), which confers a certain tension to the muscle mass. The surface of the muscle bulge is smooth but, beneath the connective fascia which overlies it, is a light longitudinal muscle bundle. The microscopic structure of the contractile part is, in fact, composed of rough bundles of smaller muscles, which in their turn are formed by muscular cells. Moreover, the presence of other transverse striations in the filaments (made up of groups of muscle cells) brings the skeletal muscles into the category of striated muscles, being the smooth structure typical of the involuntary muscles.

flexion

There are tendinous (aponeurotic) parts at each end of the bulge. The tendons characteristically have whitish fibrous tissue (aponeurosis). There is a gradual transition of the inner connective septa from the contractile parts in the tendinous sheaths. Because the tendon is almost inextensible, the traction exerted by the contractile muscle mass is easily transmitted to the point of insertion. Usually, the tendons are like cords but, when they come from flat muscles, they look level, even laminated (aponeurosis). Close to these principal structures are other, complementary ones: connective fascia, tendinous sheaths, mucous bursa. The points of entry of the muscles into the bone (by means of the tendons) are distinguishable conventionally as the point of origin (fixed point, fixed part of skeleton) and the point of insertion (moving point, more mobile part of skeleton). For the skeletal muscles this is determined according to the action of the muscle but, in some cases, the points can be swapped (a few cutaneous muscles have their insertion in the deep layers of the skin).

The form of muscles varies greatly in relation to their separate functions:

long muscles: these are extended, cylindrical, narrowing at the ends. There are different types: biceps, triceps, quadriceps (muscles formed from different muscular bundles united in one tendon of insertion), digastric (double-bellied muscle, joined by a ribbon-like tendon). Long muscles are found mainly in the limbs.

broad muscles: these are usually flattened, sometimes covered by a white fibrous sheet of tissue, mostly located in the trunk. The points of insertion are very broad and establish aponeurosis of insertion.

orbicular or sphincter muscles: these are circular in structure and not found in the skeletal muscular system.

Finally, it must not be forgotten that the muscular system is arranged in layers. These include a more or less superficial covering layer (superficial musculature) and beneath this other, deeper layers (deep musculature). Obviously, the relations between the two systems (superficial and deep) are extremely close and it is important in life drawing to observe the effect each has on the other.

long muscles

ribbon-like biceps

Muscle action

The means of movement of parts of the body are linked to the mode of mechanical function relating to the levers of the limbs of the three basic types. There are various modifications because of the different muscle arrangements and relative lines of force. A single muscle or a group of muscles rarely carries out actions on their own; more often what takes place are complex actions and particular positions, indicated by the following terms:

agonist muscles: those that are opposed in action by another muscle, given different points of origin and insertion.

antagonist muscles: these partially or totally produce opposing actions (typical examples are the extensor and the flexor muscles).

synergistic muscles: the co-operation of two or more muscles which increases the action of another, from the most limited to the most complicated, is called synergism. Synergism occurs frequently and requires a delicate balance between antagonistic strength and opposing synergistic groups.

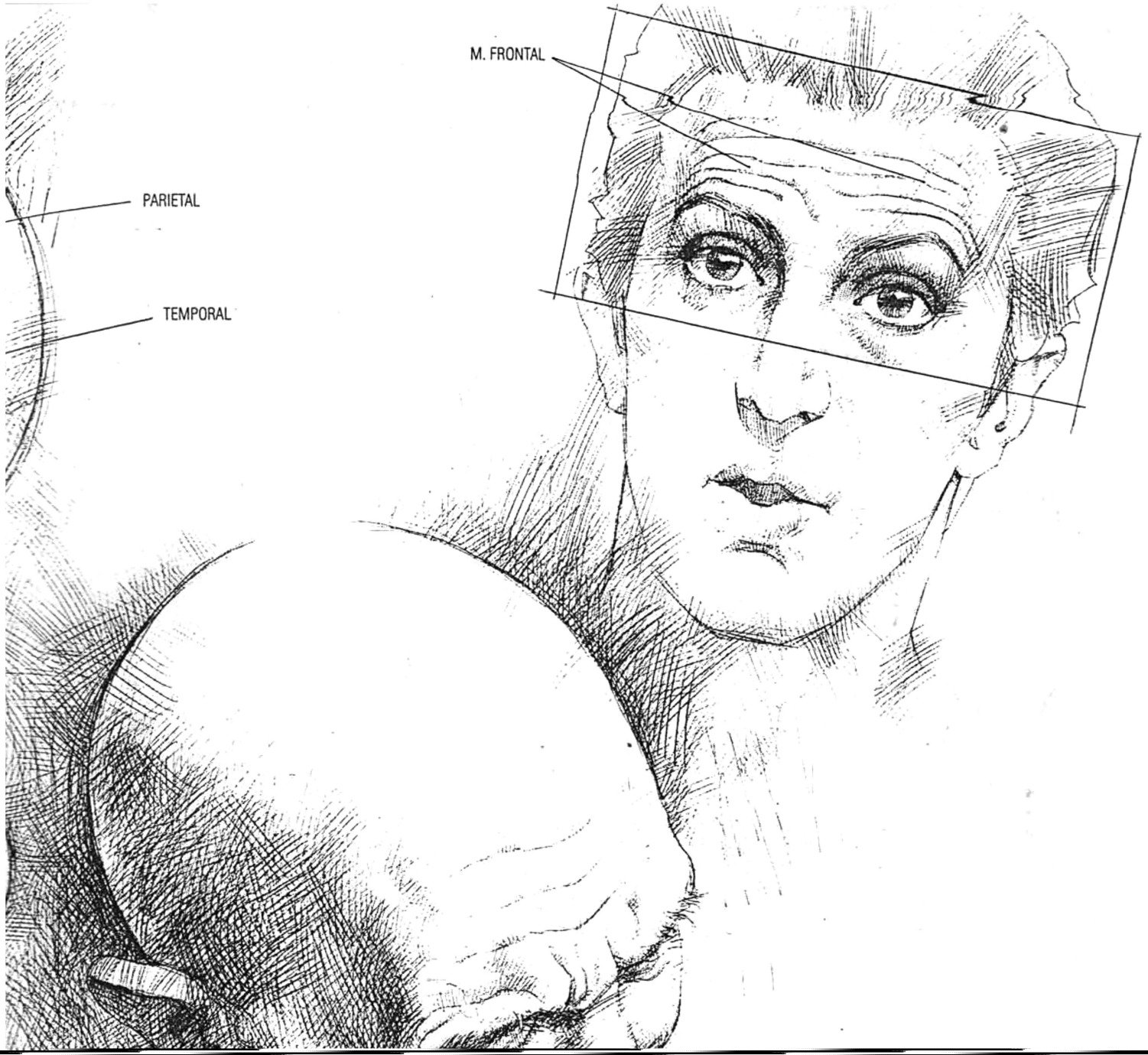
triceps digastric

broad muscle

orbicular muscle

PRACTICAL HINTS ON LIFE DRAWING

- By 'anatomical drawing' I do not mean the scientific depiction of organs and structures but simply drawing applied to the study of human anatomy, as the body appears *in vivo*, with some understanding of its morphology. For artists, the best path to understanding is by drawing. For this reason I have used sketches rather than photographs to illustrate my point. The main purpose of this book is not to teach how to draw well (that comes later with practice), but to stimulate the ability to observe from life. Even presupposing a certain technical competence in drawing, this must be subordinated to visual education, diligent observation and, above all, to paying heed to the 'canons' of


M. FRONTAL
PARIETAL
TEMPORAL

Quadratus Muscle of the Upper Lip

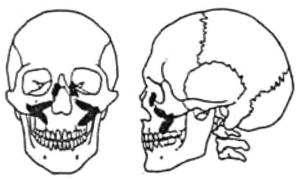
Three facial muscles meet at the upper lip: the overall action is to pull it upwards and sideways, dilating the nostrils (expressions: contempt, pity, grief, weeping)

Levator Labii Superioris Alaeque Nasi

o: frontal process of maxilla and orbicular muscle
i: wings of the nose and upper lip

Levator Labii Superioris

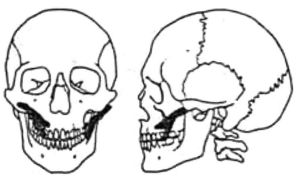
o: orbital margin of maxilla
i: wings of nose and upper lip



Zygomaticus Minor

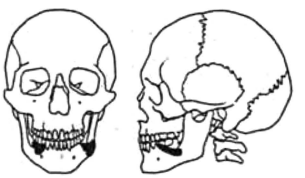
o: zygomatic bone and canine fossa
i: upper lip and angle of mouth

Zygomaticus Major



o: zygomatic bone
i: angle of mouth
a: raises upper lip and mouth high and sideways (expressions: smiling, laughing)

Risorius

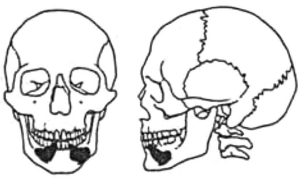


o: risorius muscle passes from parotid fascia to the skin at angle of mouth
i: corners of mouth
a: pulls corners of mouth sideways (expression: forced laugh)

ZYGOMATICUS
MAJOR

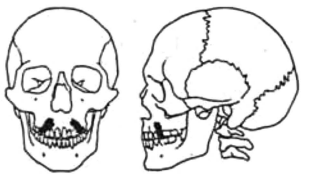
Triangularis Muscle

Covers the quadratus muscle of the lower lip (the orbicularis oris, depressor labii inferioris) strengthening its action.



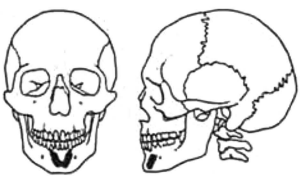
o: base of mandible
i: angle of mouth and lower lip
a: bends downwards angle of mouth and lower lip (expressions: contempt, indignation)

Levator Labii Superioris



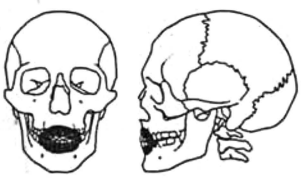
o: maxilla (canine fossa)
i: upper lip and angle of mouth

Mentalis

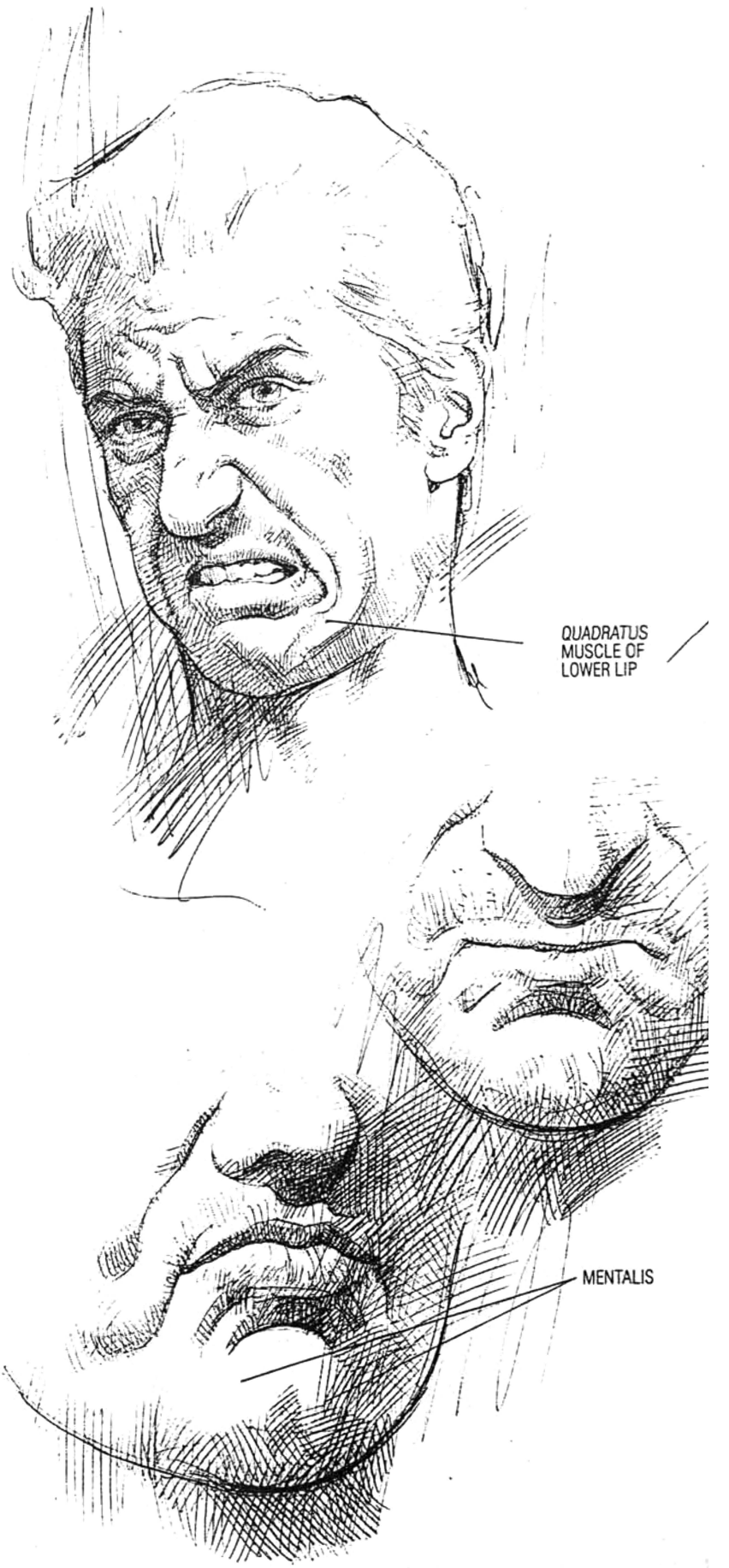


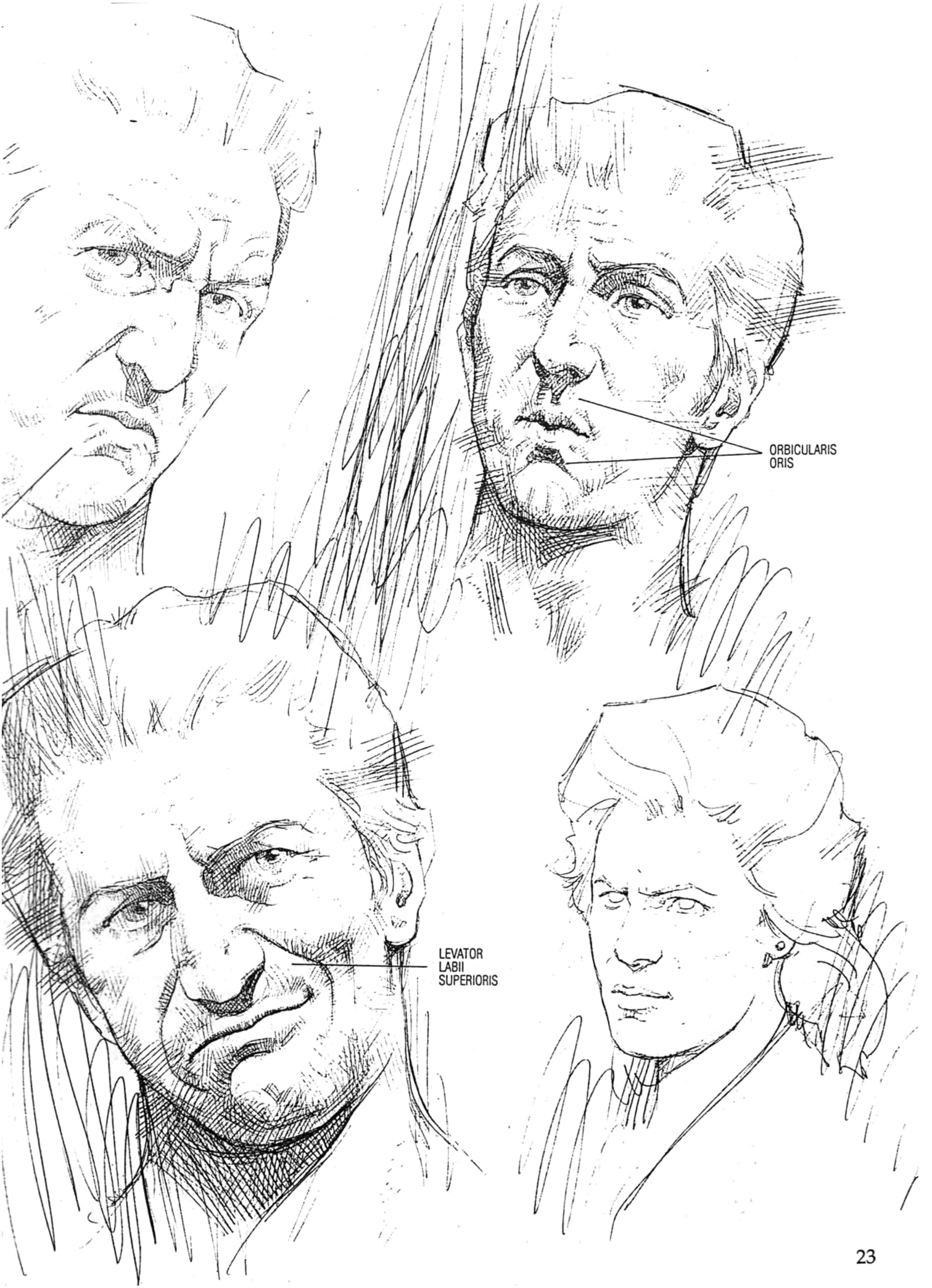
o: mandible (near incisors)
i: skin of chin
a: pulls out lower lip, wrinkles chin

Orbicularis Oris



o: muscle fibres of the buccinator (mastication) and other muscles around the mouth are joined to the small fascia of maxilla and mandible, surrounding the edge of mouth
i: skin of lips
a: closes lips and pushes them outwards (expressions: act of kissing, whistling, sucking)




ORBICULARIS
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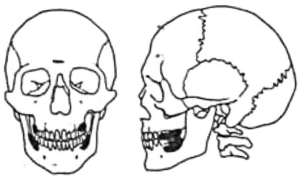
Buccinator



o: jaw (alveolar process), mandible
i: angle of mouth, upper and lower lip
a: pulls back angle of mouth, stretching the circular muscle round the cavity of mouth, and compressing lips and cheek against teeth (expressions: puffing out cheeks, blowing)

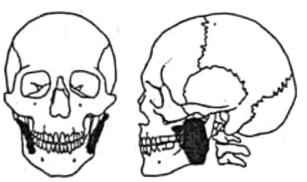
Canine Eminence

o: jaw (canine fossa)
i: orbicularis oris
a: lifts angle of mouth and sides of upper lip (expression: gnashing teeth)

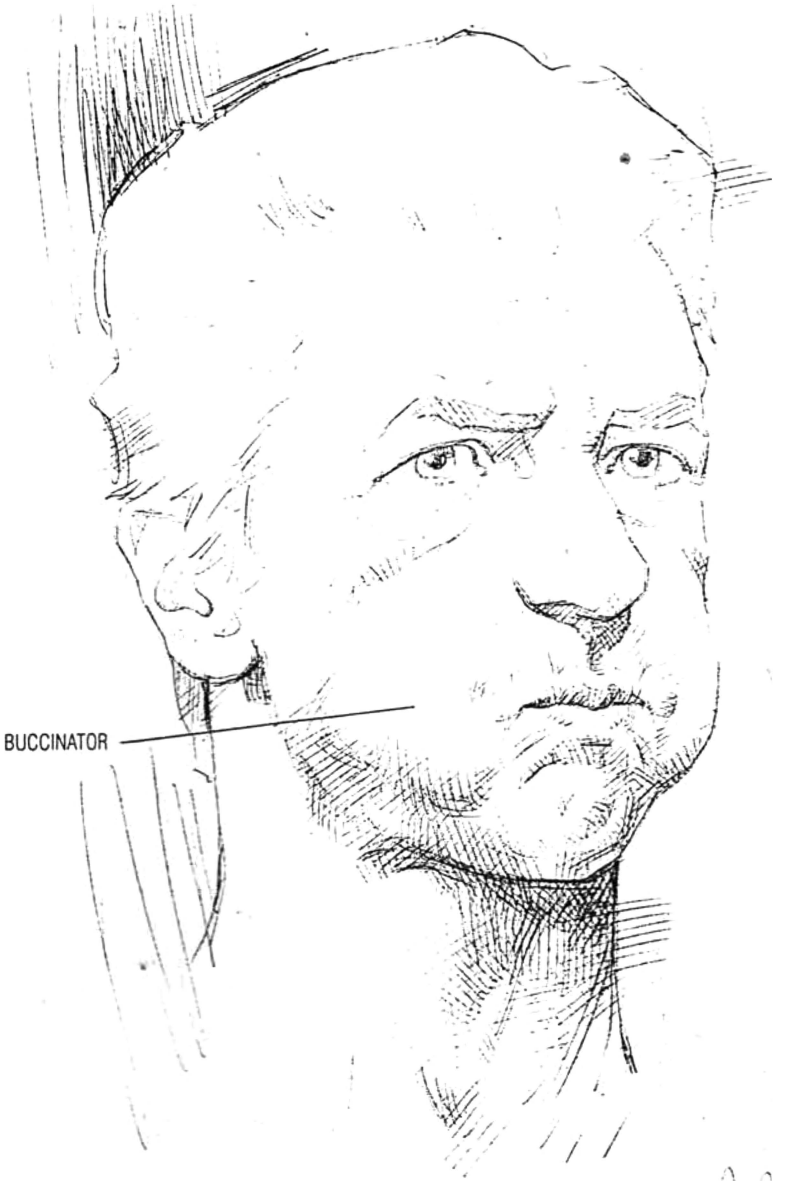
Incisor of the Upper Lip
Incisor of the Lower Lip

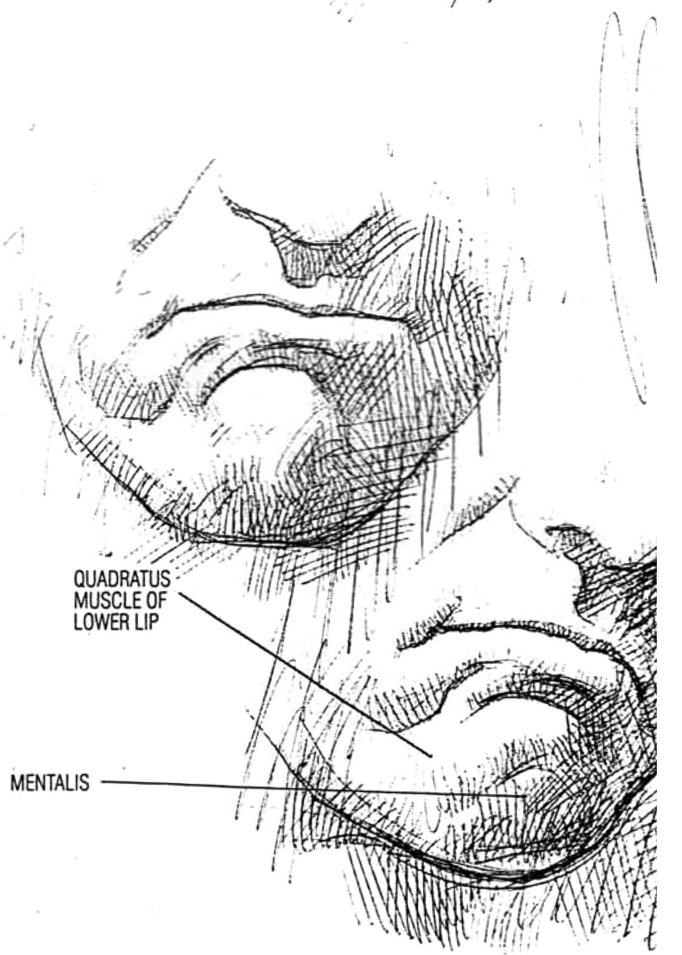
o: maxilla and mandible (alveolar fossa of incisors)
i: orbicularis oris
a: raises upper lip/depresses lower lip

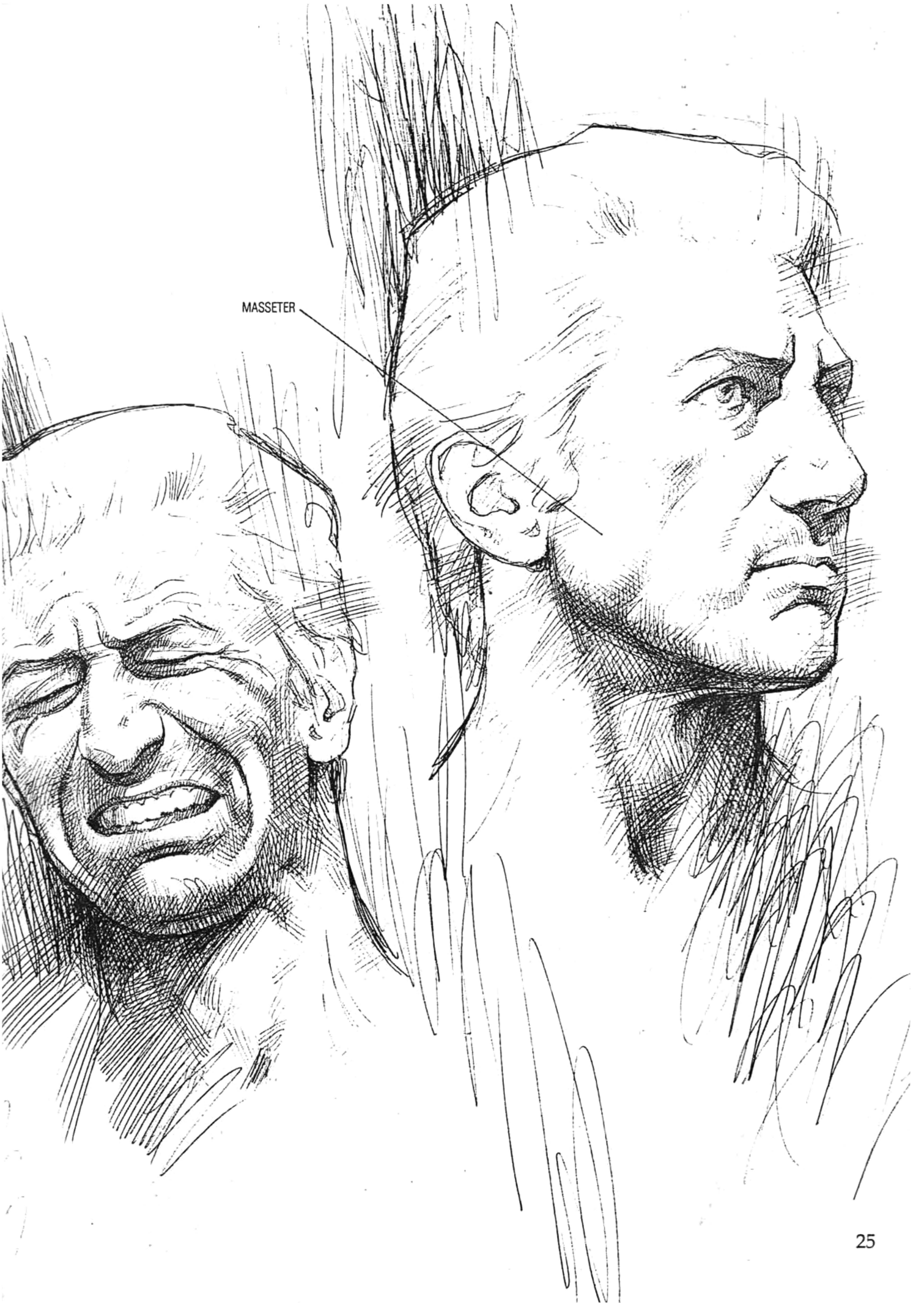
Masseter



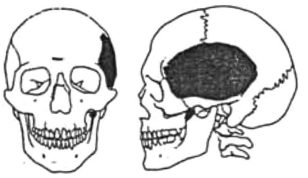
o: zygomatic arch (cheekbone)
i: lateral fascia of the ramus of mandible
a: closes mouth, raising lower jaw against maxilla (mastication), pushing out mandible (expressions: aggressive, emotional tension, anger)





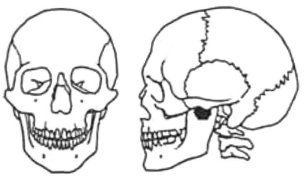

MASSETER

Temporal



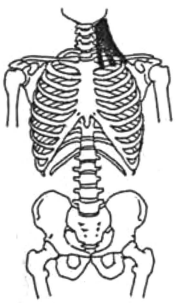
o: temporal, parietal, sphenoid (temporal fossa)
i: coronoid process of mandible
a: closes mouth (mastication), moves jaw backwards and sideways

Pterygoid

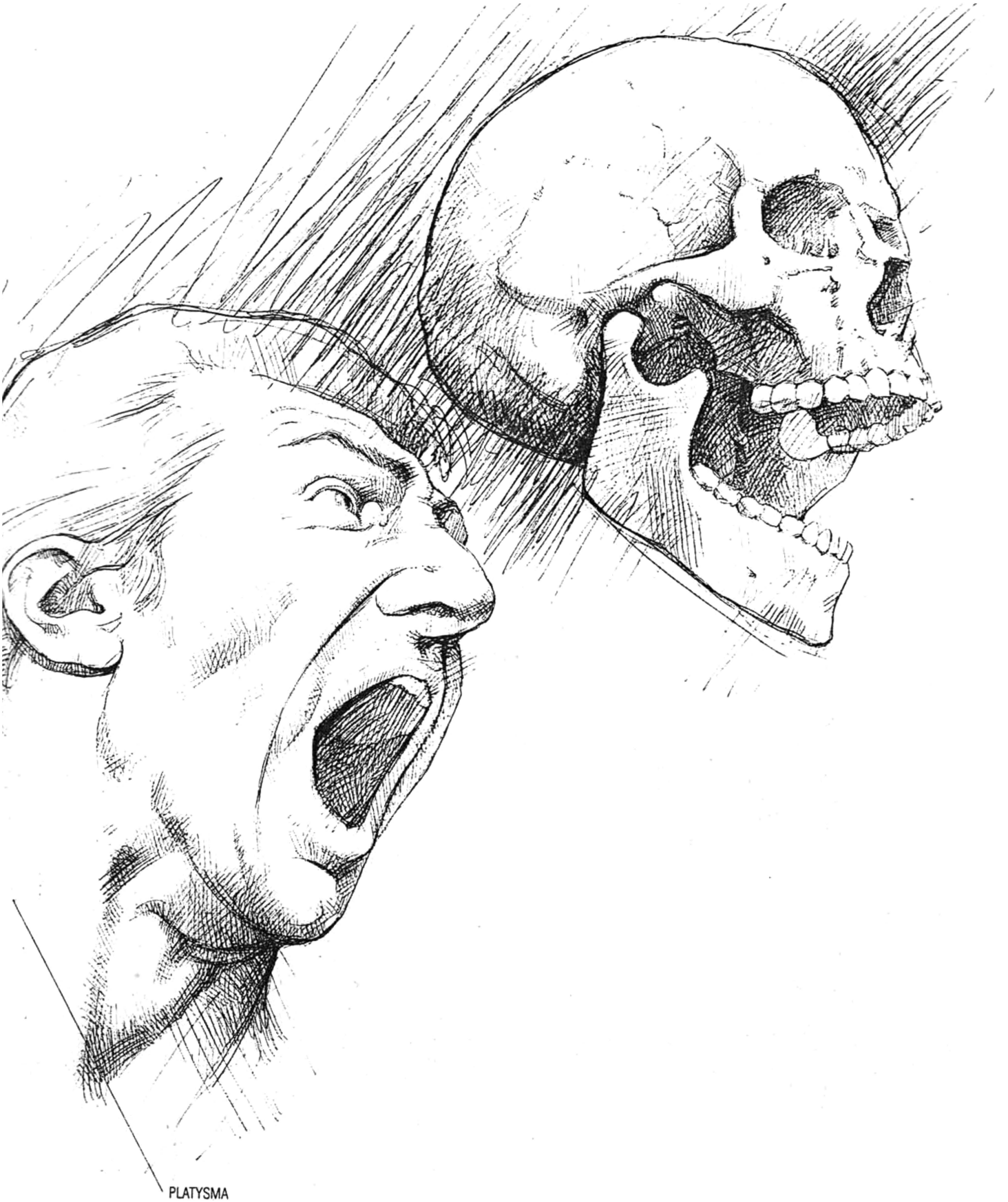


These are the lateral and medial pterygoids, the muscles that come from the external fascia of the cranial base to the medial fascia of the mandible, and are therefore insignificant in external morphology. They work together with other masticatory muscles to close the mouth and move the jaw.

Platysma



o: a sheathing from chest and shoulder to masseter and angle of mouth
i: mandible (lower jaw), with branches to angle of mouth
a: pulls down mandible and corner of mouth (expressions: this broad, thready skin muscle, under physical strain, shows anger, pain, wrinkling skin of neck)


PLATYSMA

NECK MUSCLES

The neck connects the head to the trunk. The muscles are grouped around the cervical vertebrae and the first sections of the digestive and respiratory tracts, together giving the neck a roughly cylindrical appearance, spreading out at the base into the chest.

The following groups can be distinguished: the scalenus muscles; the anterolateral muscles divided into suprahyoid and infrahyoid muscles by the presence of the hyoid bone (which covers the larynx where the thyroid cartilage is clearly visible and part of the trachea); and a lateral muscle (sternocleidomastoid). The muscles of the posterior group (trapezius, rhomboid, splenius, etc.) are related to the dorsal part of the trunk. The anterolateral musculature is sheathed by a membranous lamina over which the platysma extends and where the superficial veins of the neck run.

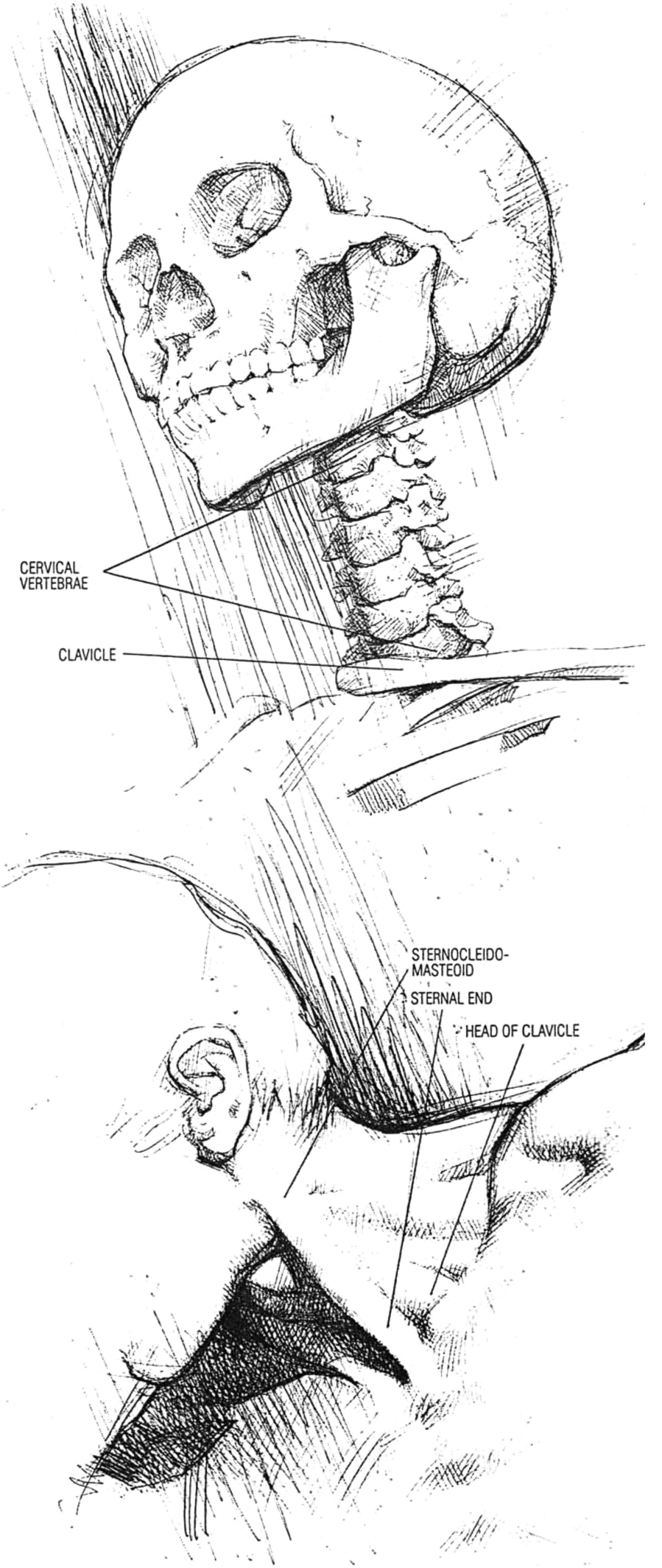
Scalenus Muscles

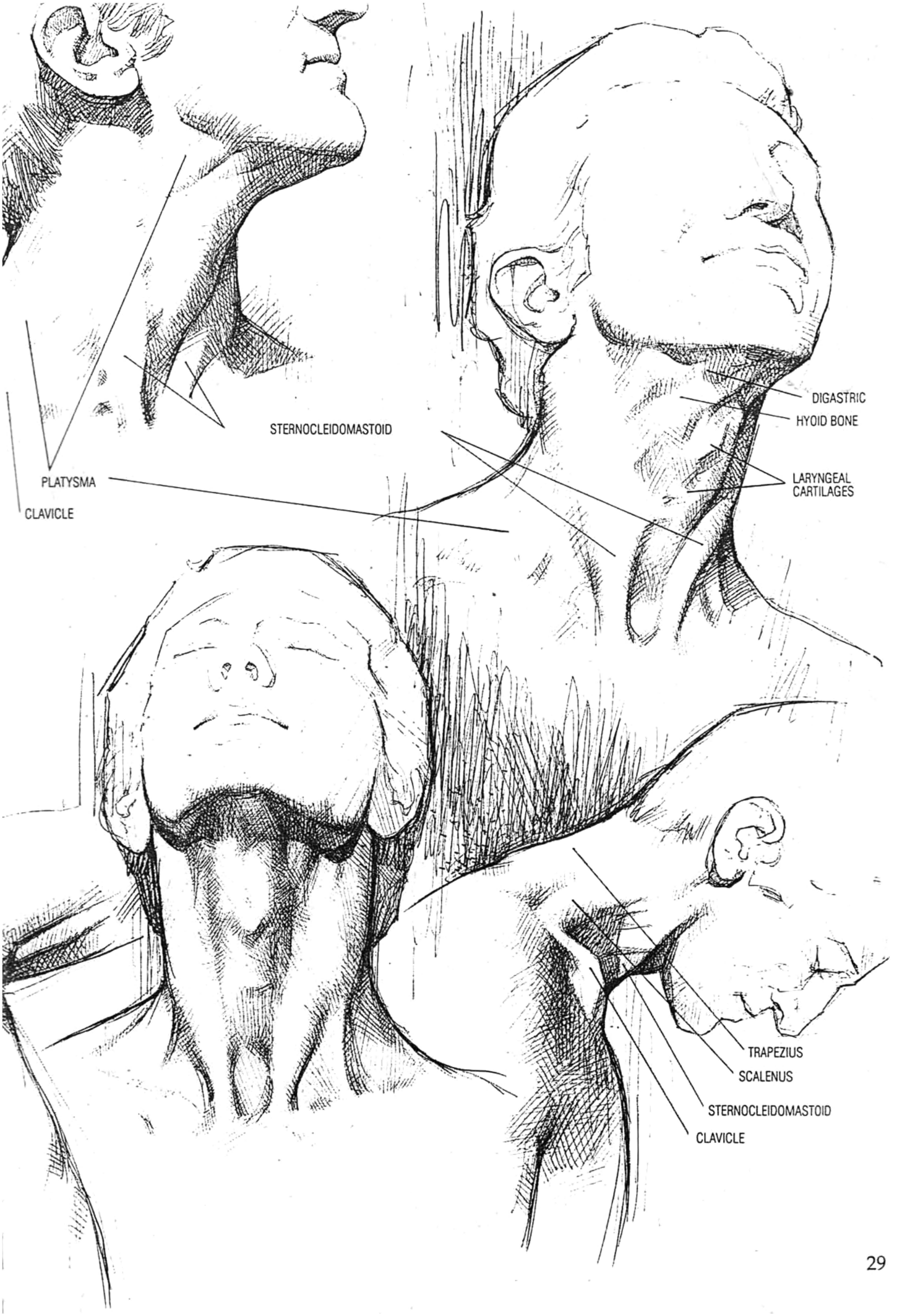
These are divided into: anterior, medius, posterior

o: transverse process of the 3rd, 4th and 5th cervical vertebrae
i: upper border of first two ribs (anterior and lateral)
a: lifts first two ribs (inhalation), bends cervical vertebral tract sideways

Sternocleidomastoid Muscle

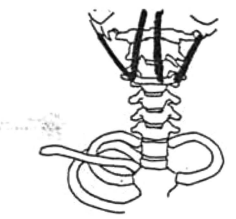
o: sternal head: manubrium of sternum (lower border); clavicular head: clavicle (upper border of sternum)
i: mastoid process of temporal and occipital bones
a: bends neck forwards and sideways, twists head




STERNOCLEIDOMASTOID
PLATYSMA
CLAVICLE
DIGASTRIC
HYOID BONE
LARYNGEAL CARTILAGES
TRAPEZIUS
SCALENUS
STERNOCLEIDOMASTOID
CLAVICLE

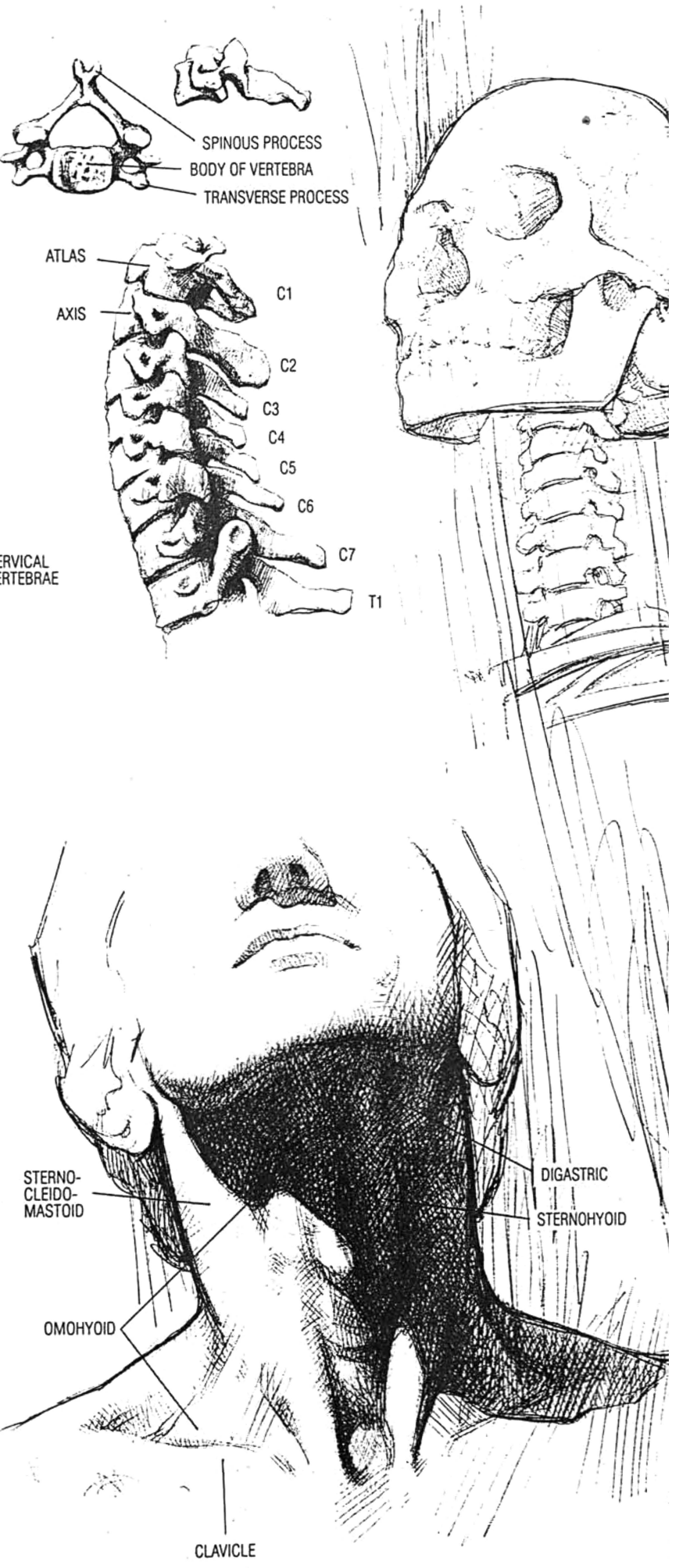
SUPERIOR HYOIDAL MUSCLES

DIGASTRIC
o: a double-bellied muscle: posterior belly, from mastoid process; anterior belly, from maxilla, behind chin (e.g. see illustrations pp. 12–13)
i: hyoid bone (to which the double bellies are fastened by a tendinous loop)
a: opens the mouth, raises hyoid and tongue



STYLOHYOID
o: temporal bone (styloid process)
i: hyoid bone (lateral border)
a: raises hyoid bone

MYLOHYOID
GENIOHYOID
o: forms floor of mouth and canopy of chin at front
i: hyoid bone
a: raises floor of mouth



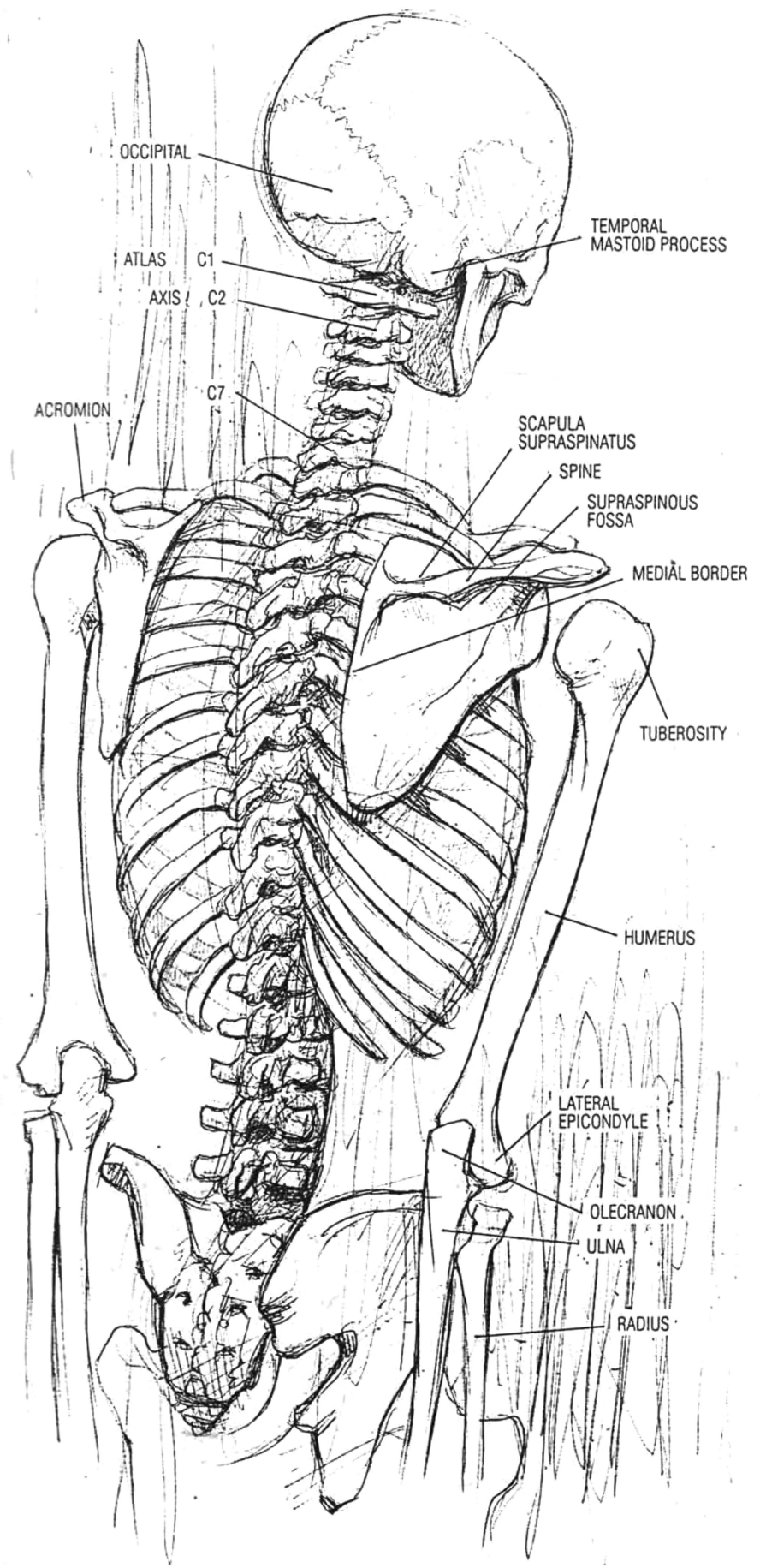
INFERIOR HYOIDAL MUSCLES

OMOHYOID

o: from hyoid bone to upper border of scapula (shoulder)
i: hyoid bone (lower lateral border). An intermediate tendon divides the muscles in the two bellies
a: draws hyoid down and to one side (helps circulation)

STERNOHYOID

o: from posterior side of sternum,

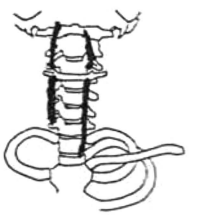


Longus Cervicis (Long Muscle of the Neck)

o: anterior vertebral muscle of the first three thoracic and last cervical vertebrae, transverse process of the cervical vertebrae
i: anterior tubercle of atlas, body of superior cervical vertebrae
a: bends and rotates the head

Longus Capitis (Long Muscle of the Head)

o: fascia: anterior tubercle of the transverse process from 3rd to 6th cervical vertebrae
i: body of occipital tubercle of the pharynx
a: bending of head and cervical tract, sideways bending, rotation

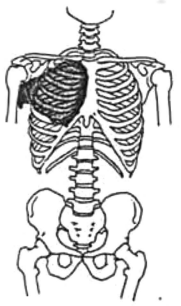


Rectus Capitis Anterior Muscle
Rectus Capitis Lateralis Muscle

o: transverse process of atlas
i: body of occipital bone
a: bending and sideways inclining of head

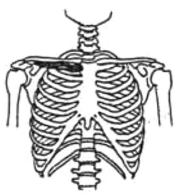
The muscles listed here relating to the head are arranged around the vertebral column or in deep layers, but are not directly noticeable in external morphological observation. They are, however, very important in helping the movements of the trunk (besides participating in walking and staying upright) and, therefore, for all the actions that derive from them.

Pectoralis Major



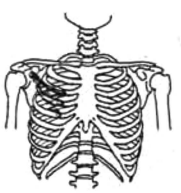
o: inner half of clavicle, sternum, manubrium and anterior fascia of the sternum, costal cartilages from 2nd to 6th ribs, fascia of abdominal muscles
i: humerus
a: adduction (draws arm downwards and forwards, raises it up), hoists trunk (climbing movement), moves the upper limbs towards centre

Subclavian Muscle



o: cartilage of 1st rib
i: clavicle (inferior fascia)
a: fastening of clavicle in sternoclavicular articulation

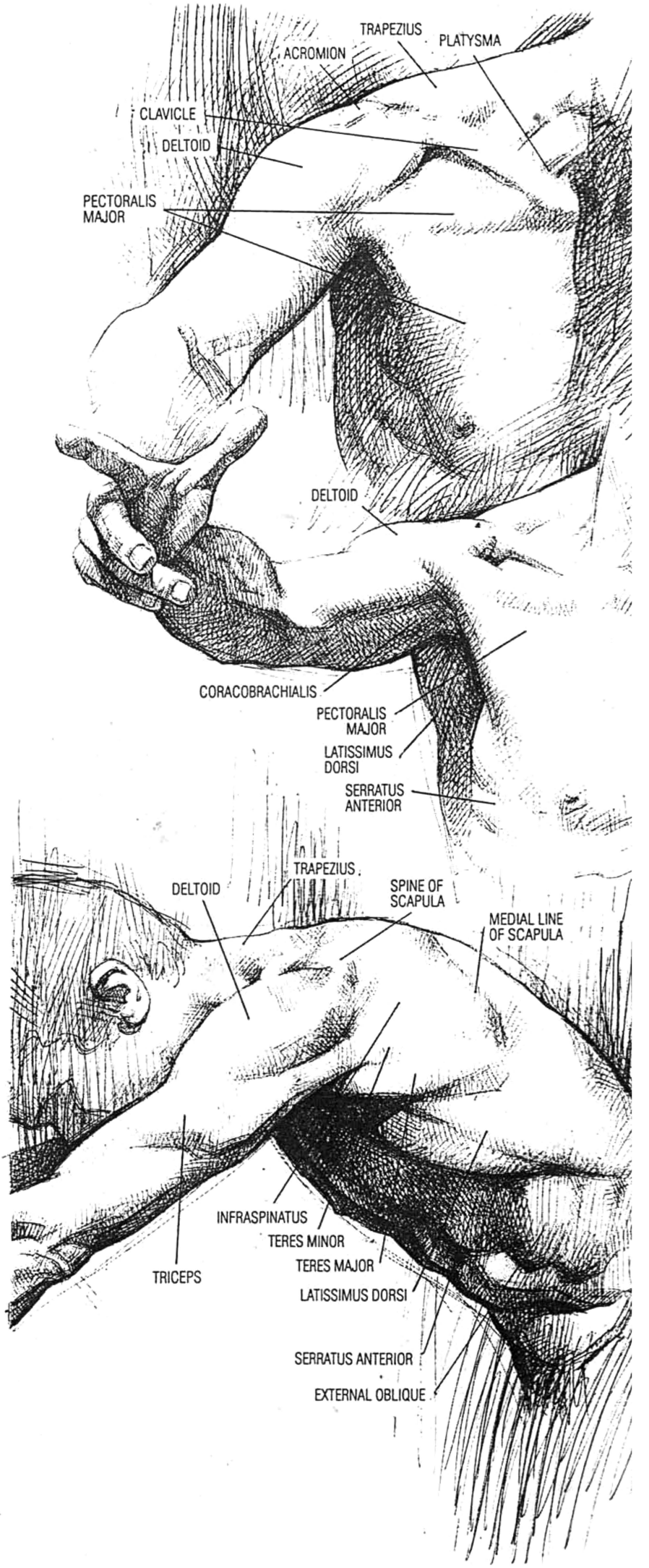
Pectoralis Minor

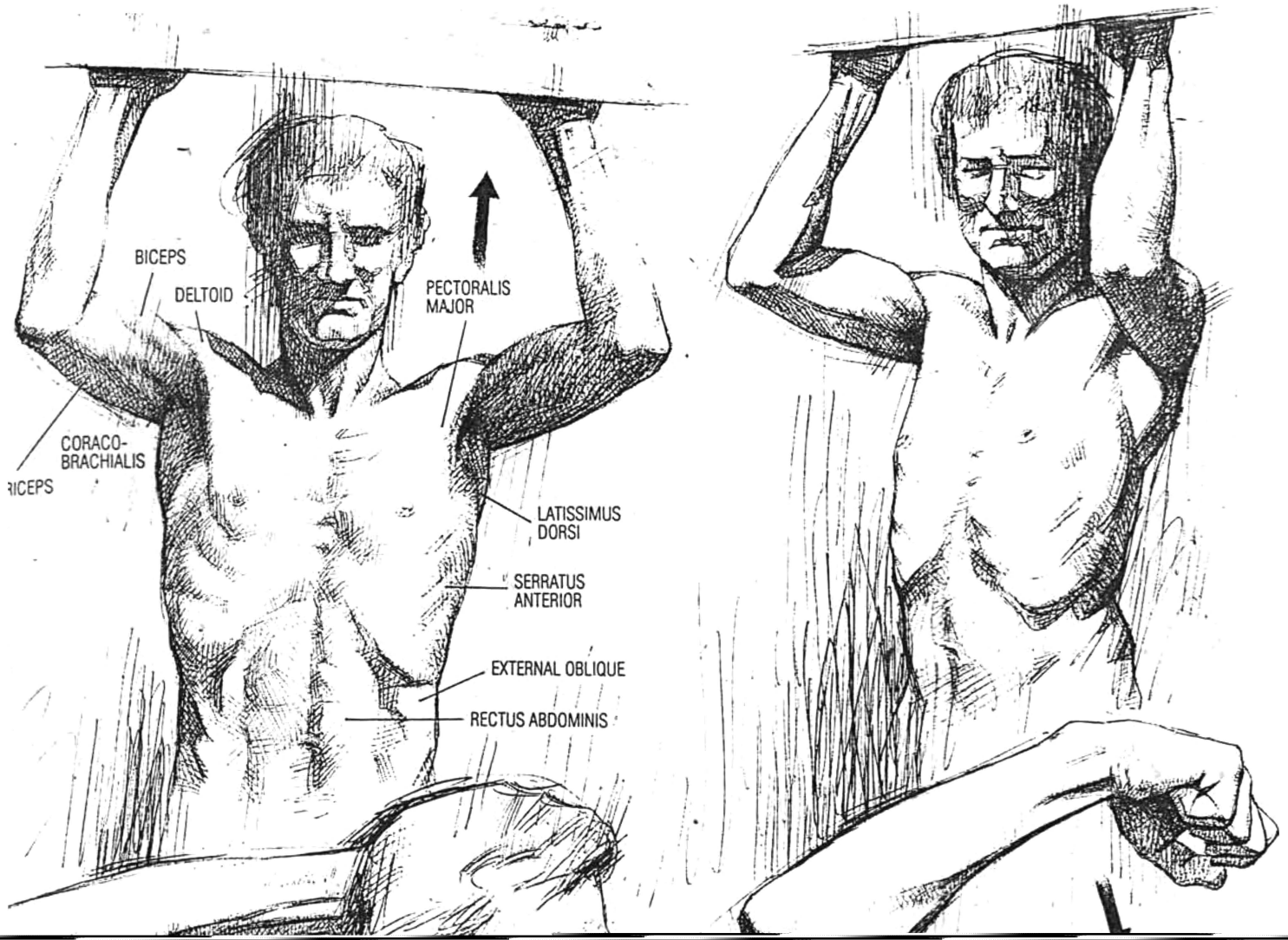


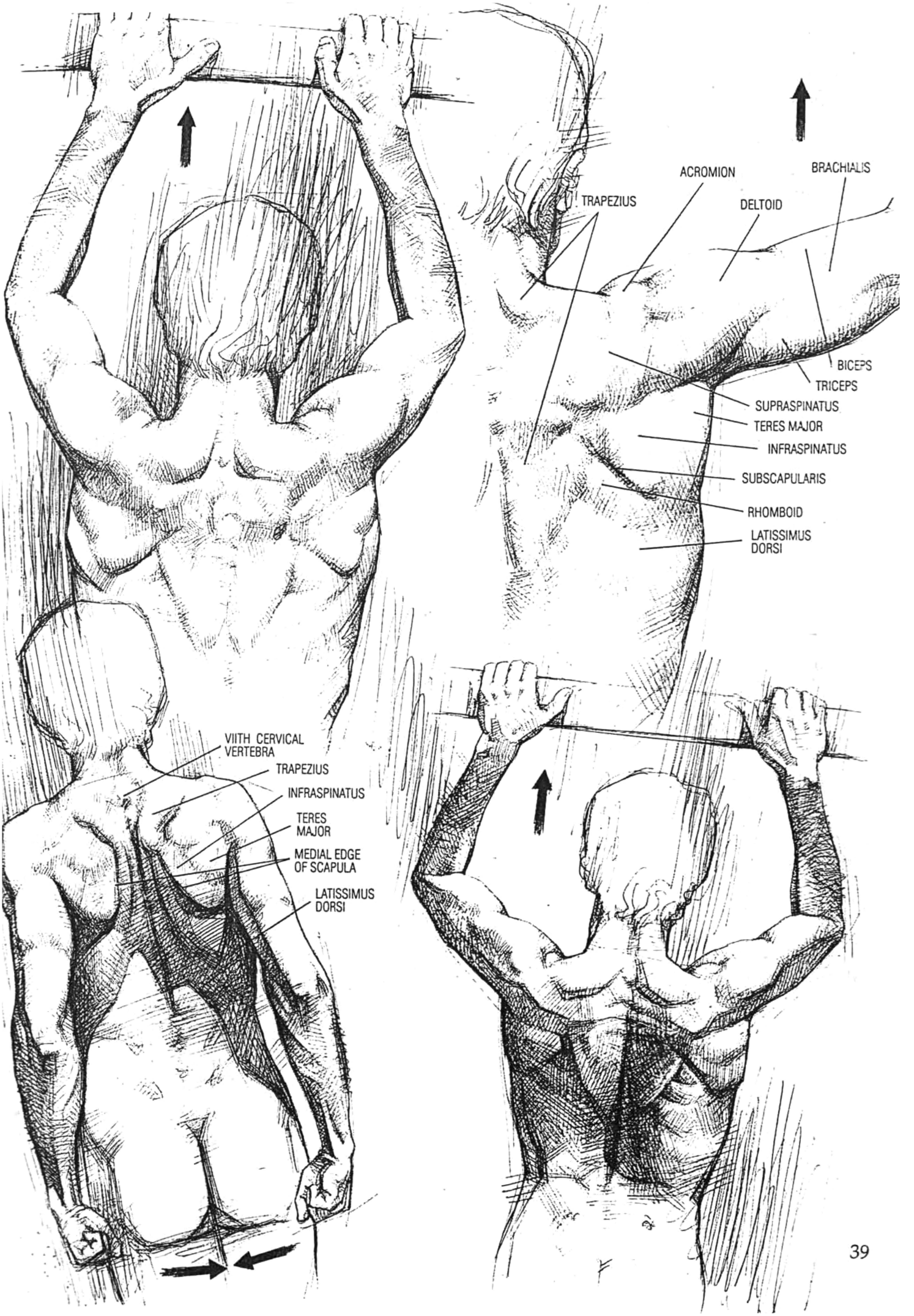
o: 3rd, 4th and 5th ribs (external fascia) to coracoid process
i: scapula (apex of coracoid process)
a: depresses point of shoulder, lifts ribs (breathing)

Serratus Anterior

o: lateral fascia of the upper nine ribs
i: scapula (spinal edge; upper angle; median fascia; medial margin; inferior fascia; lower angle)
a: pulls shoulder blade forwards (with sideways and forward traction); raises ribs (inhaling)




BICEPS
DELTOID
PECTORALIS MAJOR
CORACO-BRACHIALIS
RICEPS
LATISSIMUS DORSI
SERRATUS ANTERIOR
EXTERNAL OBLIQUE
RECTUS ABDOMINIS


ACROMION
BRACHIALIS
TRAPEZIUS
DELTOID
BICEPS
TRICEPS
SUPRASPINATUS
TERES MAJOR
INFRASPINATUS
SUBSCAPULARIS
RHOMBOID
LATISSIMUS DORSI
VIITH CERVICAL VERTEBRA
TRAPEZIUS
INFRASPINATUS
TERES MAJOR
MEDIAL EDGE OF SCAPULA
LATISSIMUS DORSI

Intercostal Muscles (Internal and External)

These close the intervals between the ribs and stretch between the internal and external margins of adjacent ribs, ending before reaching the vertebrae.

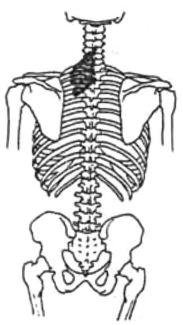
Levatores Costarum

Each levatores costarum muscle passes from the tip of the transverse process of one thoracic vertebra to the rib below the tubercle (vertebral tract and neck), and acts in breathing.

Subcostal Muscles Transversus Thoracis

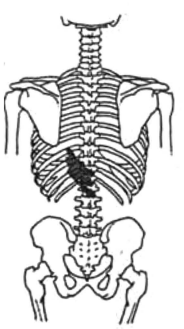
Found on internal face of ribs; function concerns respiratory movement.

Serratus Posterior Superior



o: spinous processes of last two cervical and first three thoracic vertebrae
i: outer dorsal face of ribs from the 2nd to the 5th
a: breathing (lifting of ribs)

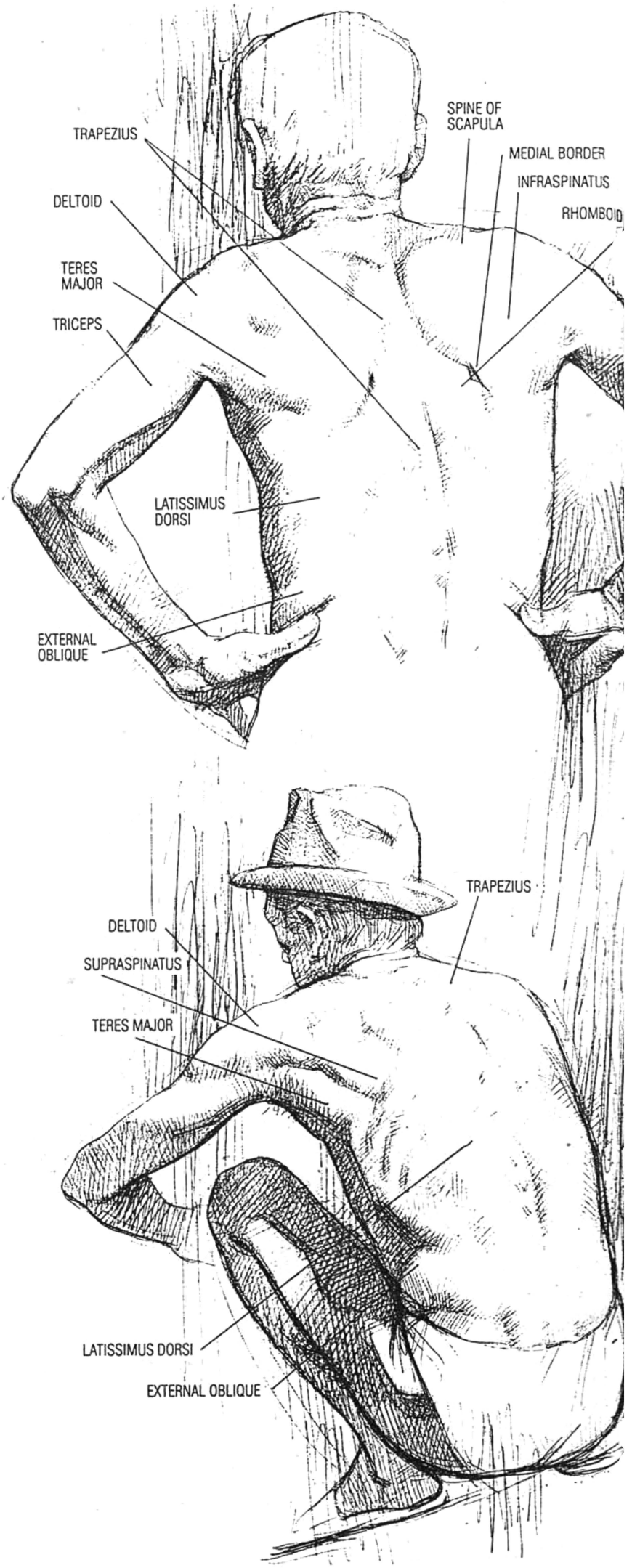
Serratus Posterior Inferior

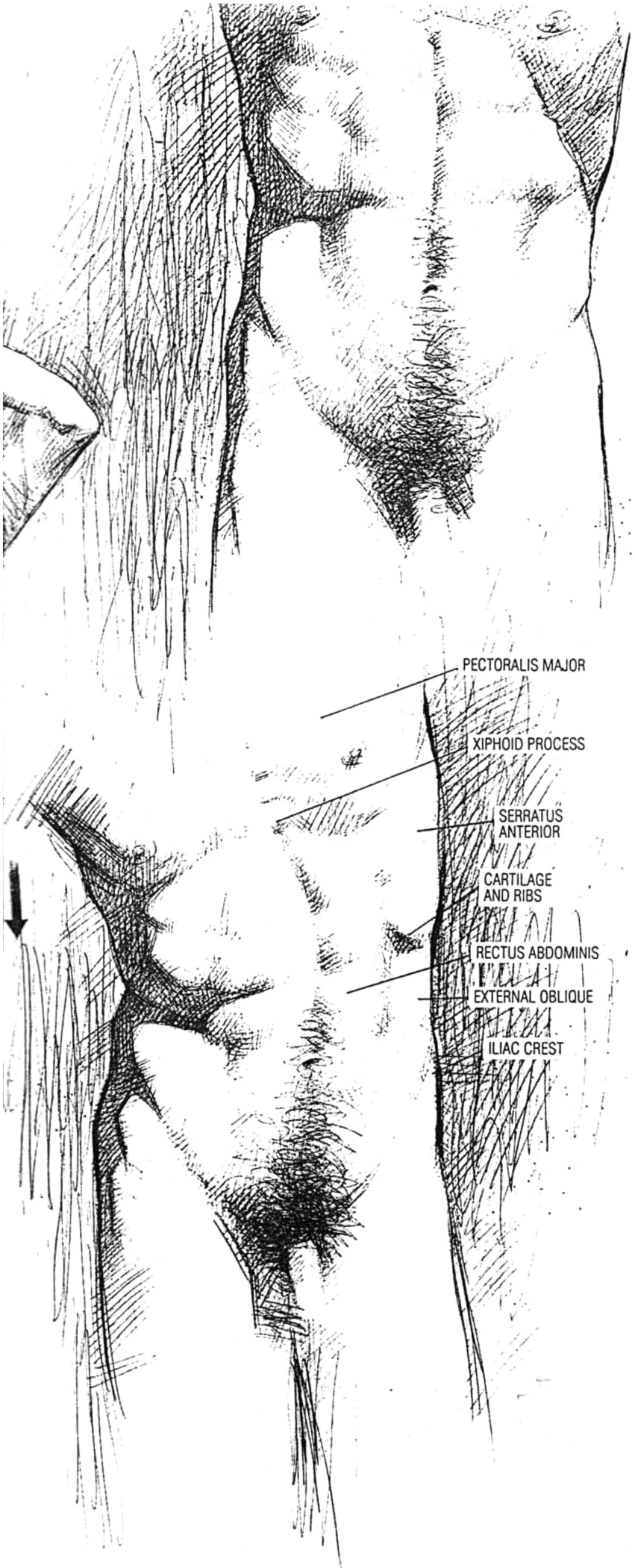


o: spinous processes from the 11th thoracic vertebra to the 2nd lumbar
i: lower posterior margins of last four ribs
a: exhalation (lowering of ribs)

Diaphragm Muscle

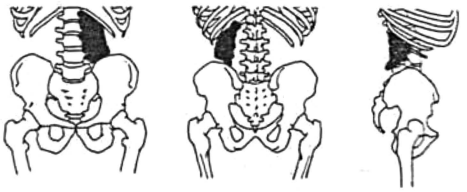
Dome-shaped muscle lamina, the fascia originating in the lumbar, costal and sternal regions, meeting at the phrenic centre; separates thoracic cavity from abdomen; mainly visceral action.





Quadratus Lumborum

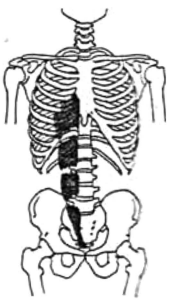
o: iliac crest (posterior tract, inner margin)
i: 12th rib, costiform process of the lumbar vertebrae
a: lateral folding of the spinal column and the thoracic cage



Rectus Abdominis

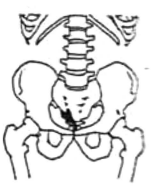
This is formed by two separate parallel muscles on the medial plane from the symphysis pubis to rib cartilages. Other abdominal muscles are inserted into its fibrous covering.

o: costal cartilages from the 5th, 6th and 7th ribs, sternum (anterior)
i: symphysis pubis
a: flexes thorax, raises the pelvis and lowers limbs, containment of the abdominal viscera



Pyramidalis

o: symphysis pubis (in front of the insertion of the rectus)
i: linea alba
a: tension of the linea alba



UPPER LIMB MUSCLES

The upper limb is made up of a free part (specifically the arm, forearm and hand) and it articulates with the shoulder girdle (scapula, clavicle) at the level of the shoulder.

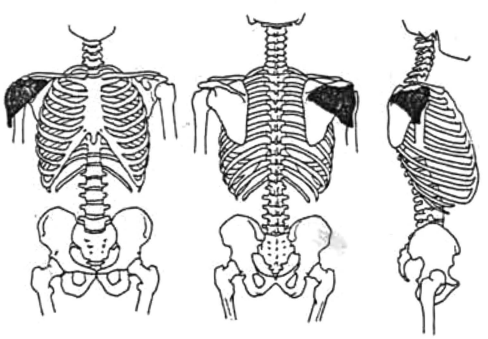
The arm is a flattened cylinder on the lateral plane, with the muscles arranged round the humerus in two groups: anterior (flexor) and posterior (extensor)

The shape of the forearm is a cone flattened in the front–back direction. The muscles around the ulna (medially placed) and the radius (laterally) are flexors (anterior cavity) with the fleshy mass beside the articulation of the elbow, and the thin tendinous part near the wrist (containing the ligaments of the carpus).

The hand is flattened, complex in form due to the presence of many bones (carpus, metacarpus, phalanges). Only the palm shows muscles, covered by the palmar fascia; on the back, only the sheathed tendons of the extensor muscles are visible.

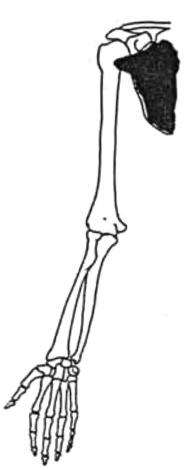
The upper limb, apart from characteristic movements of pronation and supination of the forearm, presents numerous articulations with great freedom of movement (and consequently orientation of the axes of the segments) which must be taken into consideration in making artistic representations.

Deltoid Muscle

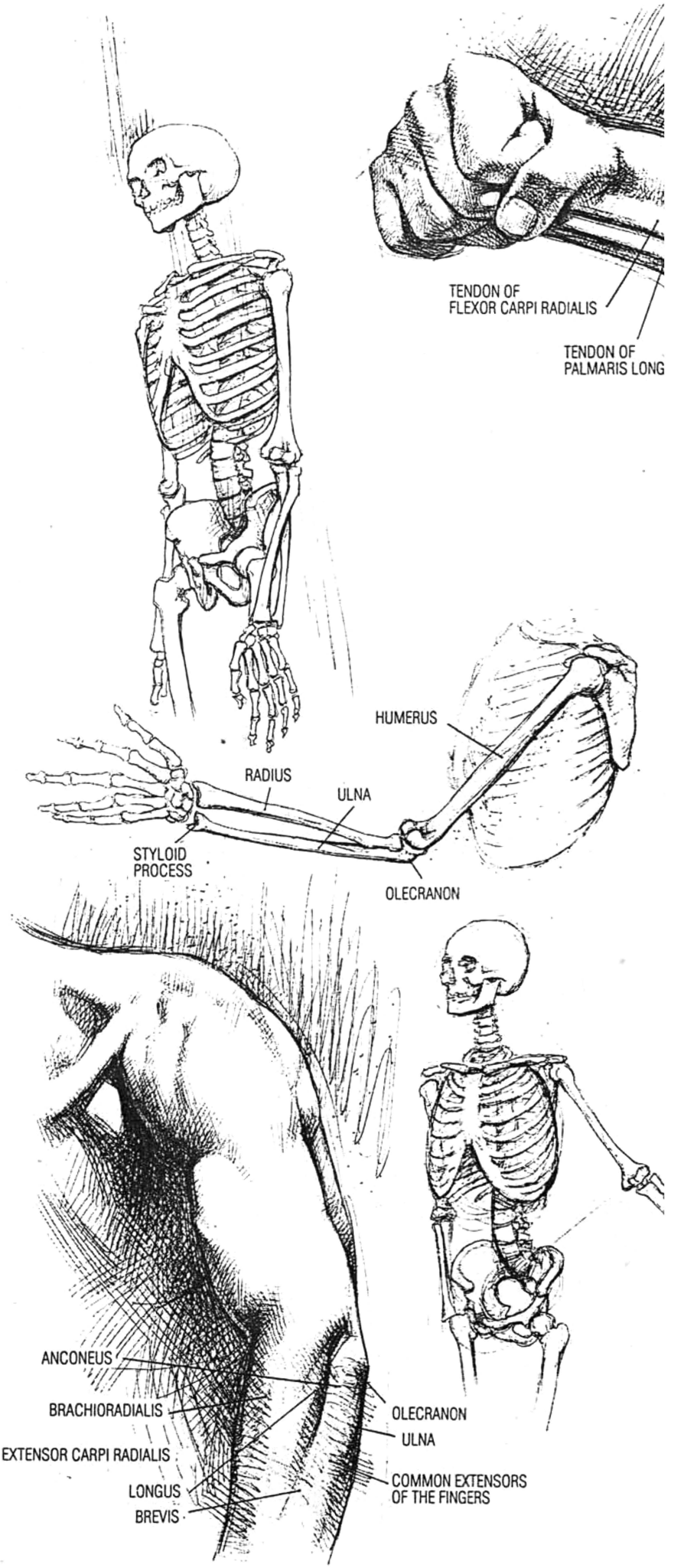


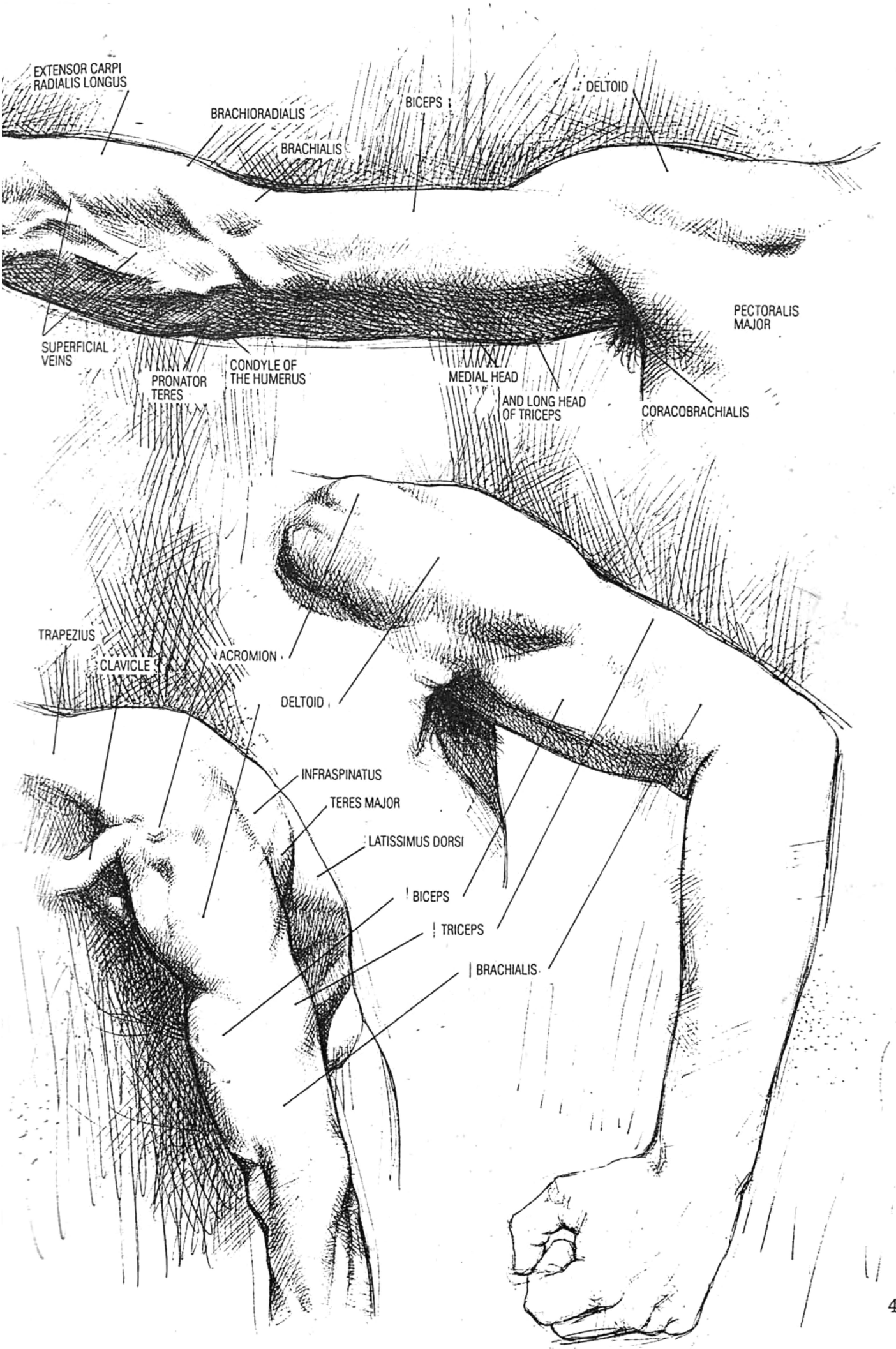
o: clavicle (collar bone), scapula (acromion and spine, lower margin)
i: humerus (outside edge)
a: abduction of the arm (contraction of the inner muscle), draws humerus backwards and forwards (contraction of anterior fascia); dorsal and medial movement (contraction of the posterior fascia)

Subscapularis



o: scapula (costal side)
i: humerus (top, front, small tuberosity)
a: rotates the arm medially

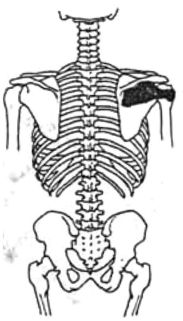



EXTENSOR CARPI RADIALIS LONGUS
BRACHIORADIALIS
BRACHIALIS
BICEPS
DELTOID
PECTORALIS MAJOR
SUPERFICIAL VEINS
PRONATOR TERES
CONDYLE OF THE HUMERUS
MEDIAL HEAD
AND LONG HEAD OF TRICEPS
CORACOBRACHIALIS
TRAPEZIUS
CLAVICLE
ACROMION
DELTOID
INFRASPINATUS
TERES MAJOR
LATISSIMUS DORSI
BICEPS
TRICEPS
BRACHIALIS

Supraspinatus

o: scapula (supraspinous fossa)
i: humerus (upper condyle, anterior face; large tuberosity)
a: rotates arm outwards, abduction

Infraspinatus

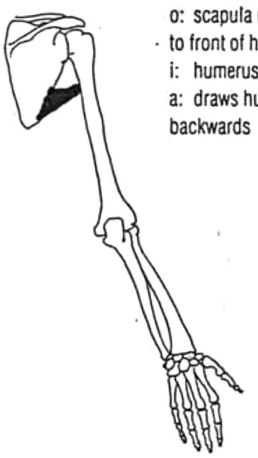


o: scapula (infraspinatus, back)
i: humerus (upper condyle, posterior face; large tuberosity)
a: rotates arm outwards and backwards

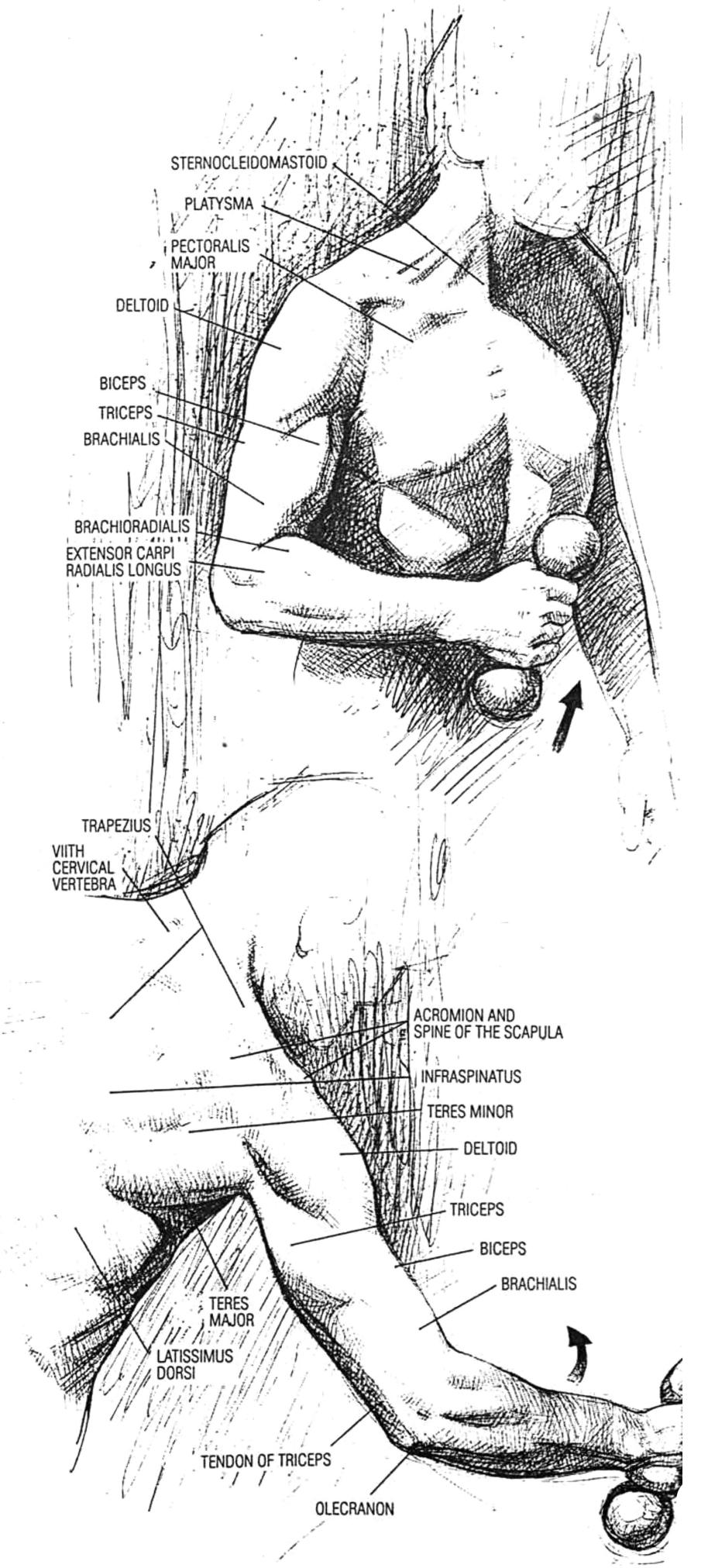
Teres Minor

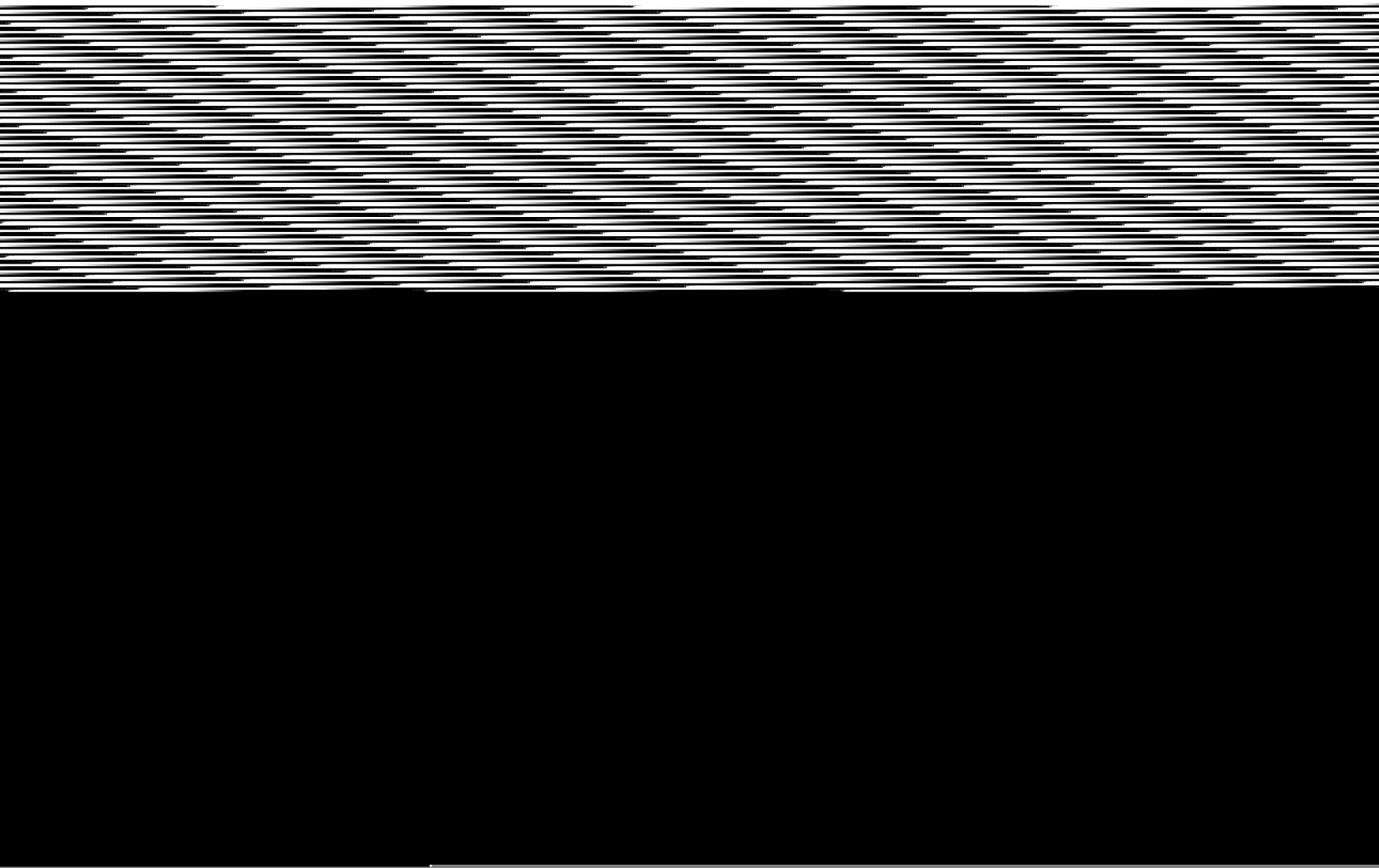
o: scapula (dorsal side, to inner tubercle of humerus)
i: humerus (upper condyle, posterior face, large tubercle)
a: draws humerus outwards and rotates arm backwards, adduction

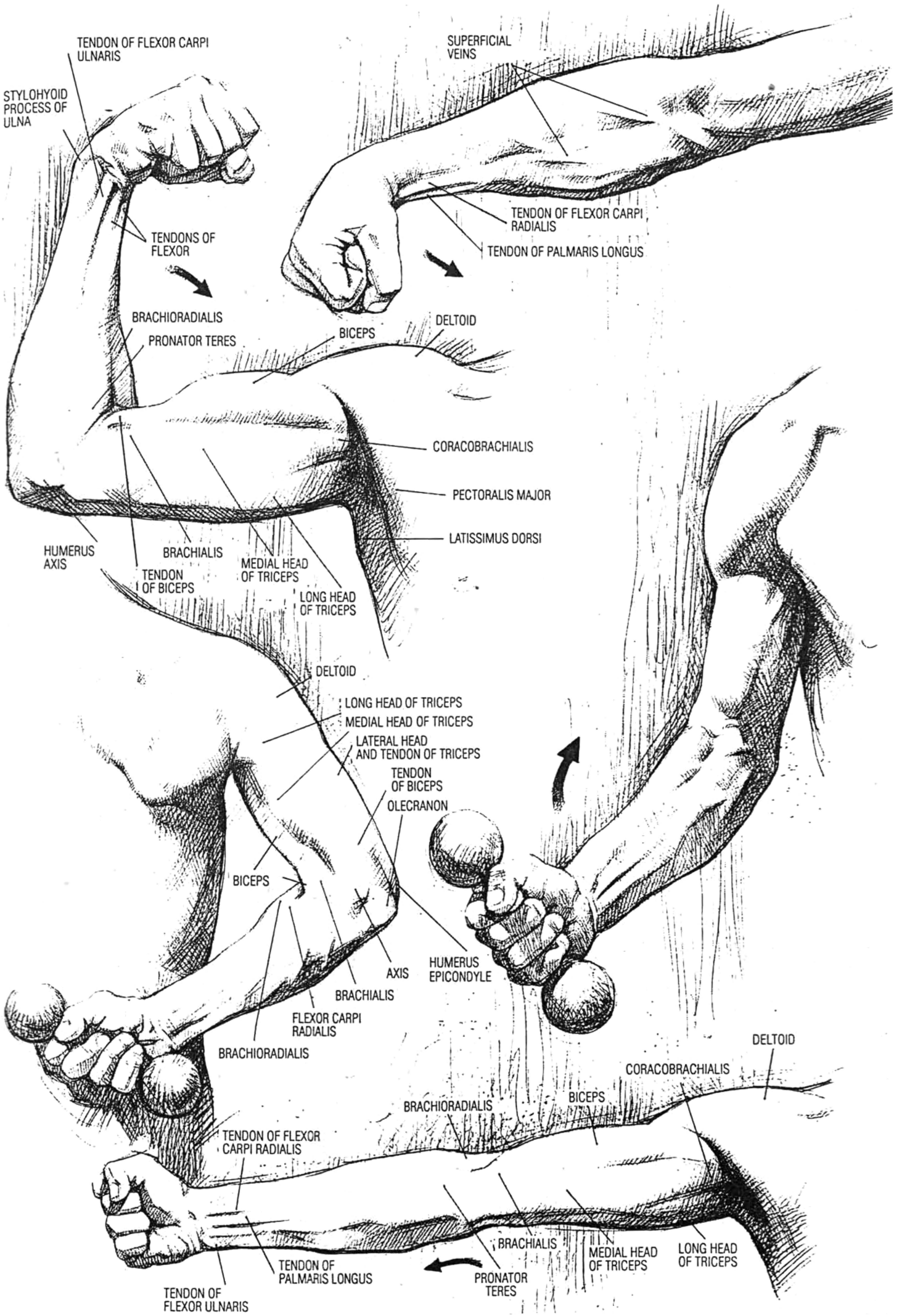
Teres Major



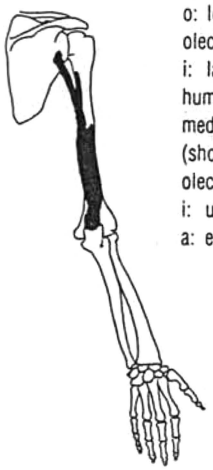
o: scapula (from lower corner of scapula to front of humerus)
i: humerus (upper condyle, anterior face)
a: draws humerus outwards and rotates backwards





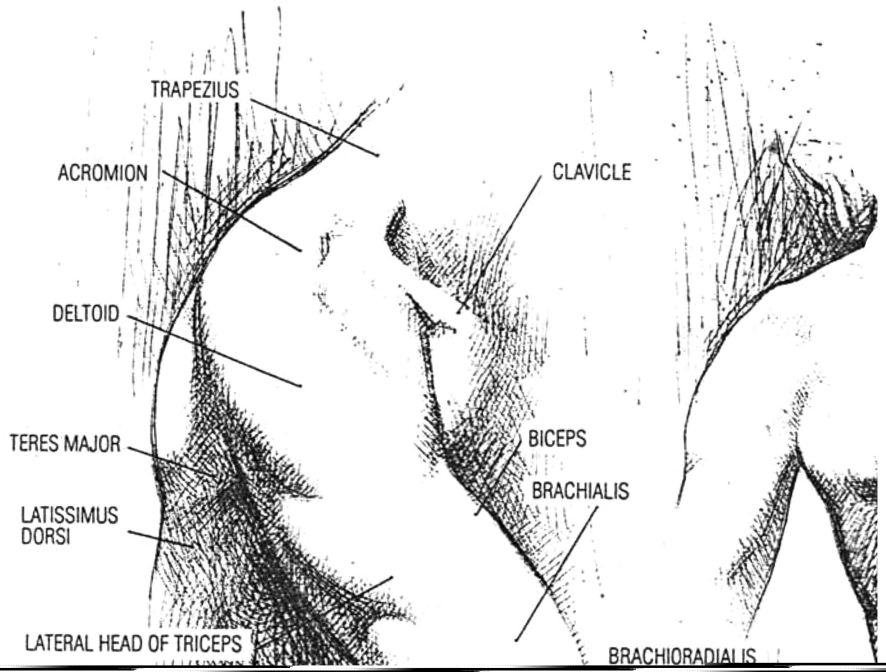

TENDON OF FLEXOR CARPI ULNARIS
STYLOHYOID PROCESS OF ULNA
SUPERFICIAL VEINS
TENDONS OF FLEXOR
TENDON OF FLEXOR CARPI RADIALIS
TENDON OF PALMARIS LONGUS
BRACHIORADIALIS
PRONATOR TERES
BICEPS
DELTOID
CORACOBRACHIALIS
PECTORALIS MAJOR
LATISSIMUS DORSI
HUMERUS AXIS
BRACHIALIS
TENDON OF BICEPS
MEDIAL HEAD OF TRICEPS
LONG HEAD OF TRICEPS
DELTOID
LONG HEAD OF TRICEPS
MEDIAL HEAD OF TRICEPS
LATERAL HEAD AND TENDON OF TRICEPS
TENDON OF BICEPS
OLECRANON
BICEPS
AXIS
HUMERUS EPICONDYLE
BRACHIALIS
FLEXOR CARPI RADIALIS
BRACHIORADIALIS
DELTOID
CORACOBRACHIALIS
BICEPS
BRACHIORADIALIS
TENDON OF FLEXOR CARPI RADIALIS
BRACHIALIS
MEDIAL HEAD OF TRICEPS
LONG HEAD OF TRICEPS
TENDON OF PALMARIS LONGUS
PRONATOR TERES
TENDON OF FLEXOR ULNARIS

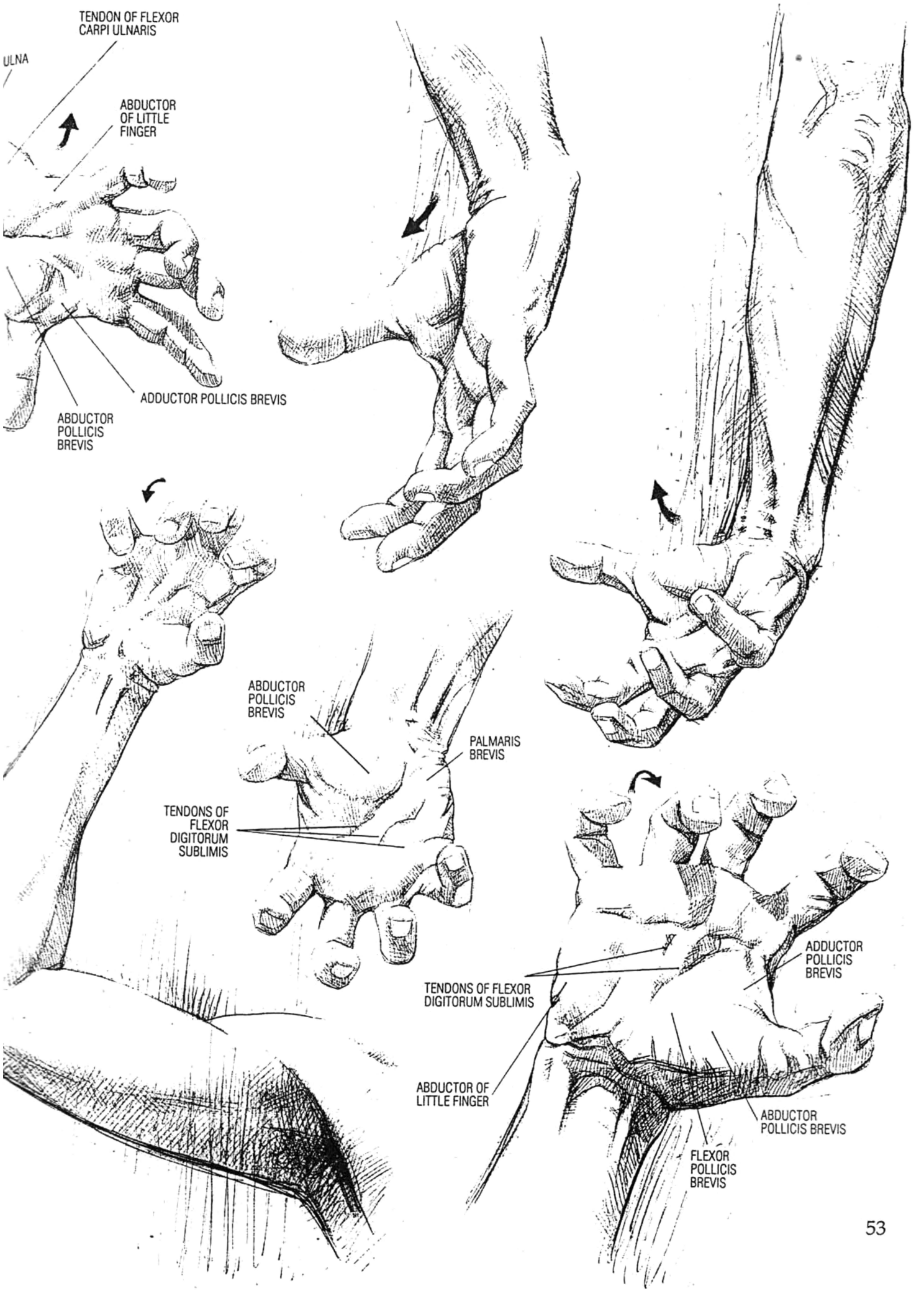
Triceps



o: long head: scapula (below socket to olecranon process of ulna)
i: lateral head: humerus (back of humerus, above musculospinal group); medial (or deep) head: humerus (shoulder blade below socket to olecranon process of ulna)
i: ulna (olecranon), with broad tendon
a: extends forearm

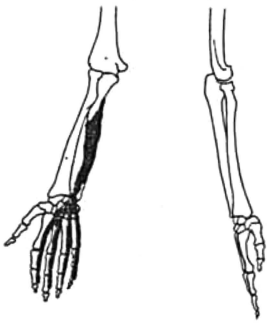
Anconeus



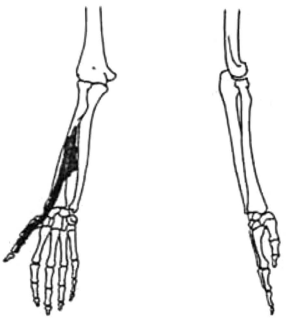

TENDON OF FLEXOR CARPI ULNARIS
ULNA
ABDUCTOR OF LITTLE FINGER
ADDUCTOR POLLICIS BREVIS
ABDUCTOR POLLICIS BREVIS
ABDUCTOR POLLICIS BREVIS
PALMARIS BREVIS
TENDONS OF FLEXOR DIGITORUM SUBLIMIS
TENDONS OF FLEXOR DIGITORUM SUBLIMIS
ADDUCTOR POLLICIS BREVIS
ABDUCTOR OF LITTLE FINGER
ABDUCTOR POLLICIS BREVIS
FLEXOR POLLICIS BREVIS

Flexor Digitorum Profundus

o: ulna (front), interosseous membrane
i: last phalanx (palmar surface) of the four fingers
a: flexes fingers (but not thumb)



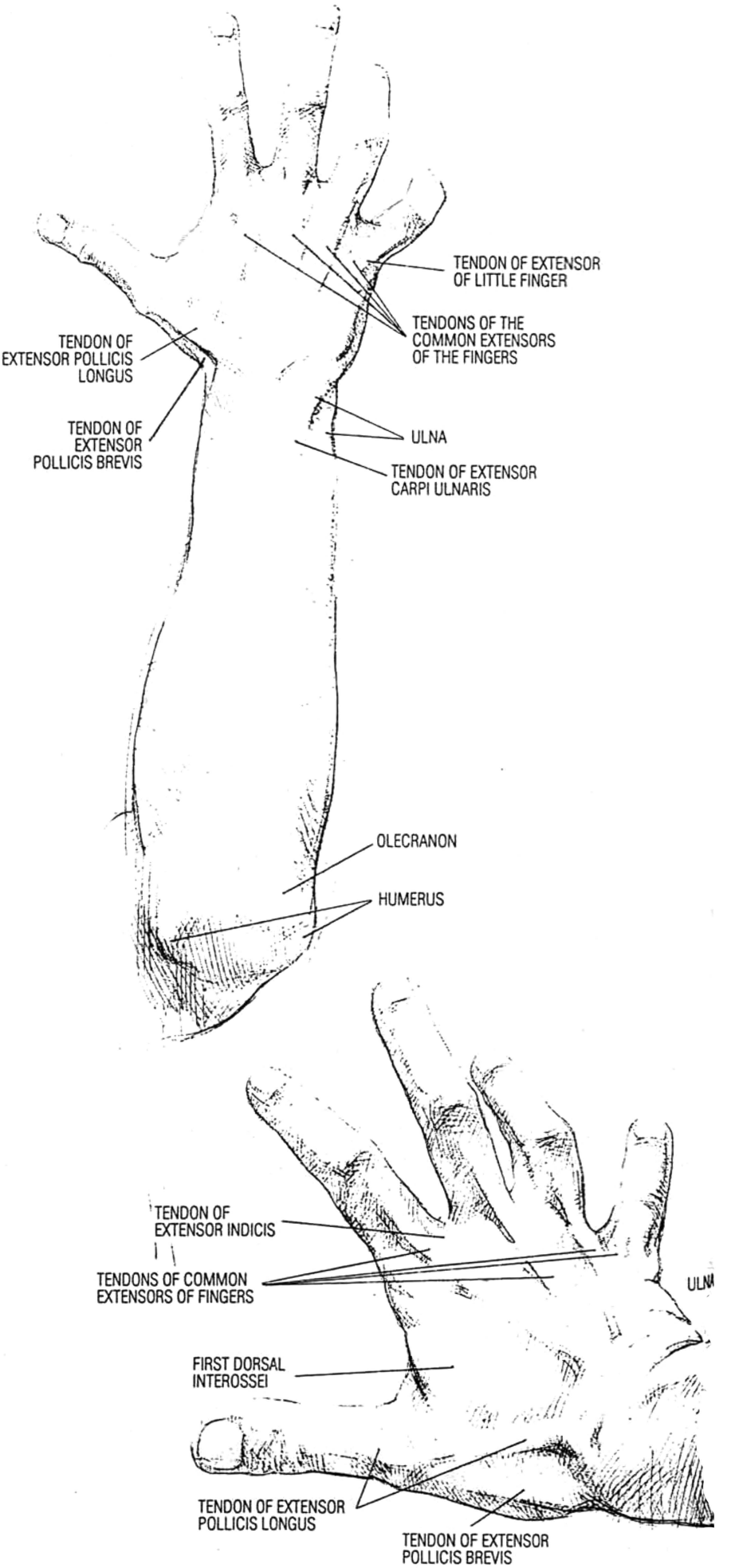
Flexor Pollicis Longus



o: radius (middle tract, front), interosseous membrane
i: thumb (2nd phalanx, palmar surface)
a: flexes thumb

Pronator Teres

o: ulna (internal condyle to outer side of radius, half-way down)
i: radius (outer side)
a: pronates hand and flexes forearm

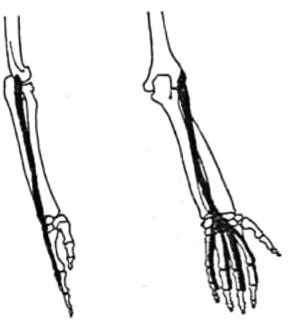


Extensor Muscle of Little Finger

o: humerus (lateral epicondyle)
i: phalanges of the 4th finger (dorsal surface)
a: extends little finger

Extensor Muscle of the Fingers

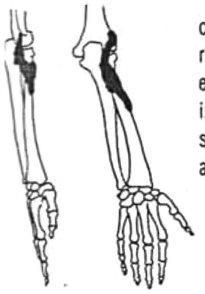
o: humerus (lateral epicondyle, posterior face)
i: phalanges of the four fingers (dorsal surface, tendinous sheath)
a: extends fingers (but not thumb) and hand



Extensor Carpi Ulnaris

o: humerus (lateral epicondyle, posterior face); ulna (posterior surface)
i: 5th metacarpal (dorsal surface at end)
a: extension and adduction of hand

Supinator



o: humerus (from external condyloid ridge to end of radius, ligaments of elbow); ulna (lateral surface)
i: radius (upper part, anterior and lateral surfaces)
a: supinates forearm

Abductor Pollicis Longus

o: ulna (middle part, posterior surface); interosseous membrane; radius (posterior surface)
i: 1st metacarpal (lateral surface at base)
a: extension and abduction of thumb

Extensor Pollicis Brevis

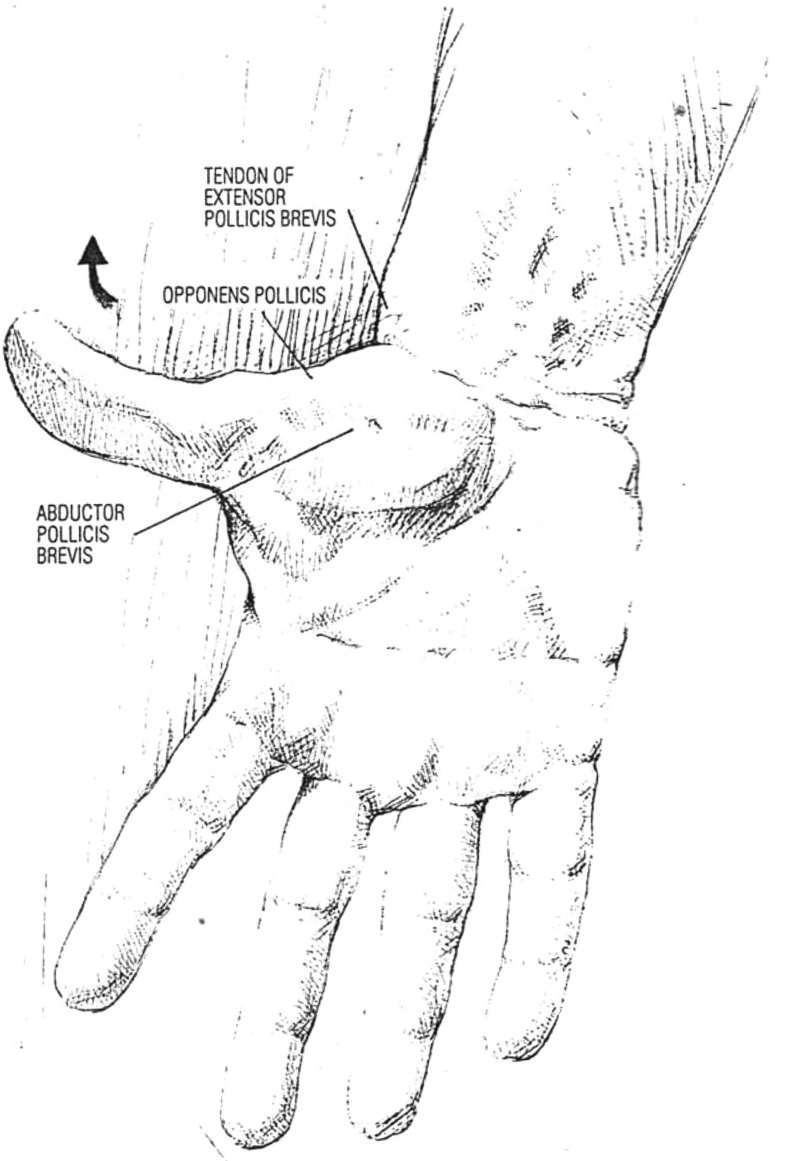
o: radius (posterior surface, middle part); interosseus membrane
i: 1st phalanx of thumb (dorsal surface)
a: extension of 1st phalanx of thumb; abduction of hand

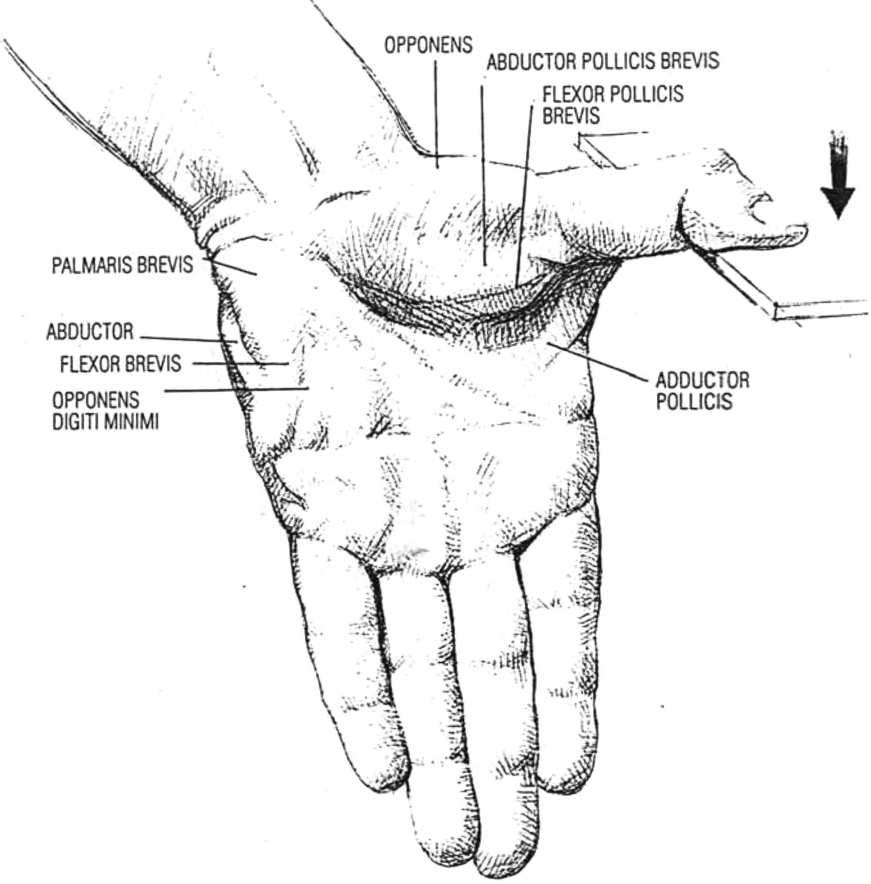
Extensor Pollicis Longus

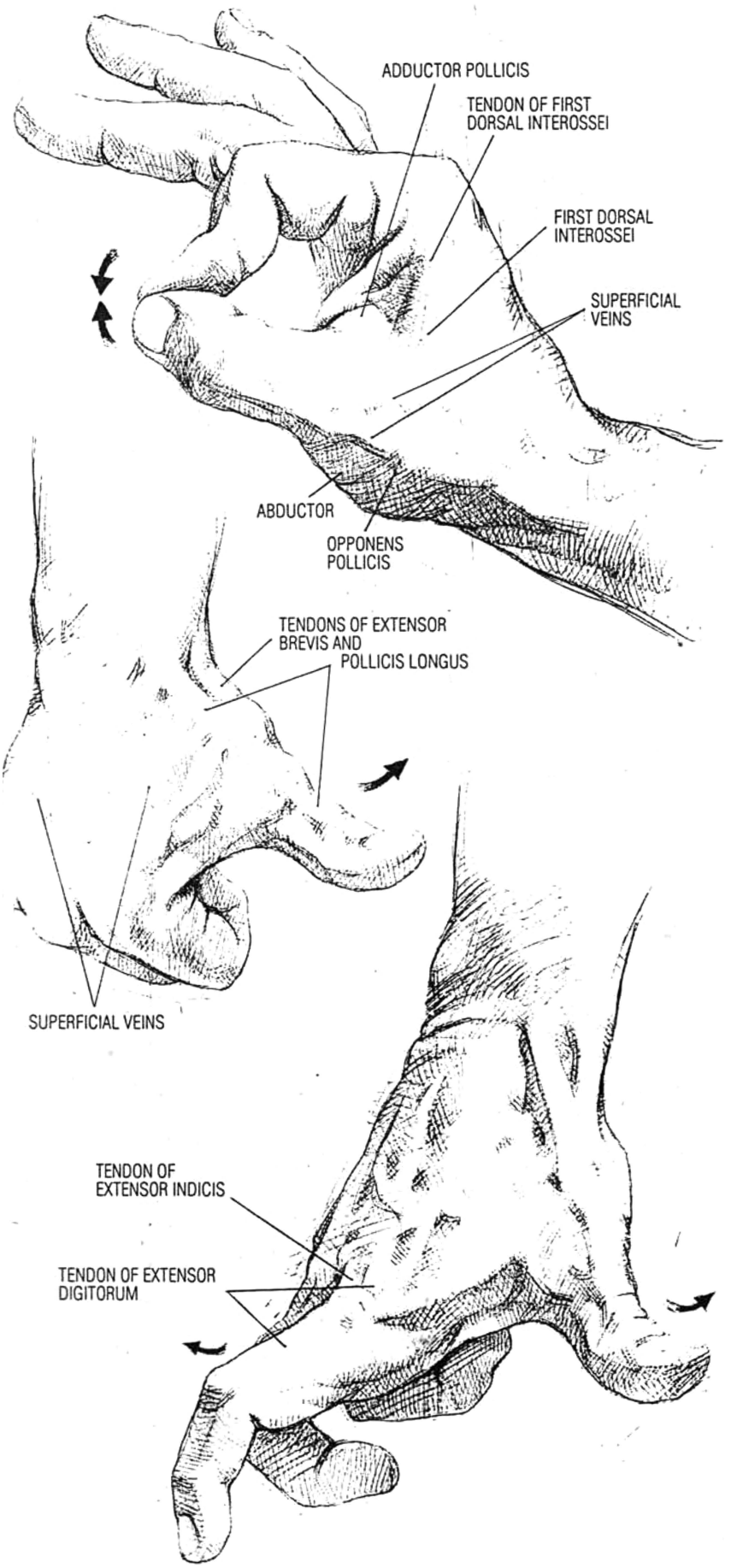
o: ulna (middle part, posterior surface); interosseus membrane
i: 2nd phalanx of thumb (dorsal surface)
a: extension of the 2nd phalanx of thumb; abduction of thumb

Extensor Indicis

o: ulna (middle part, posterior surface); interosseous membrane
i: dorsal surface of 1st finger (tendinous sheath)
a: extension of index finger







Abductor Pollicis Brevis

o: scaphoid (wrist bone); transverse ligament of wrist
i: 1st phalanx of thumb (lateral surface at base)
a: abduction of thumb; adduction of 1st metacarpal towards axis of hand

Flexor Pollicis Brevis

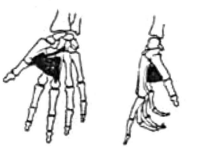
o: double-headed from palmar surface of wrist (transverse ligament, trapezium, capitate bone)
i: 1st phalanx of thumb (lateral surface of base)
a: flexes thumb; adduction and opposition of thumb

Opponens Pollicis

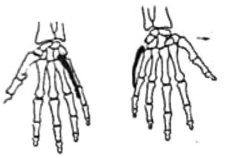
o: trapezium (palmar surface), transverse ligament of wrist
i: 1st metacarpal (lateral surface)
a: opposition to thumb from fingers

Adductor Pollicis

o: double-headed: capitate bone, hamate (palmar surface); 2nd and 3rd metacarpals (anterior surface)
i: 1st phalanx of thumb (medial surface of base)
a: adduction and opposition of thumb



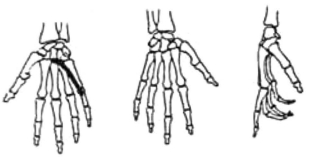
Abductor Digiti Minimi



o: pisiform (anterior surface)
i: 1st phalanx of 4th (little) finger (medial surface of base)
a: abduction (moving away of little finger from axis of the hand)

Flexor Ditigi Minimi Brevis

o: hamate bone (anterior surface); transverse ligament
i: 1st phalanx of 4th (little) finger (medial surface)
a: flexion and abduction of little finger



Opponens Digiti Minimi

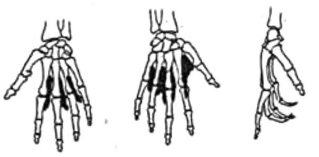
o: hamate bone (anterior surface); transverse ligament
i: 5th metacarpal (medial side)
a: opposition of little finger to thumb

Lumbrical

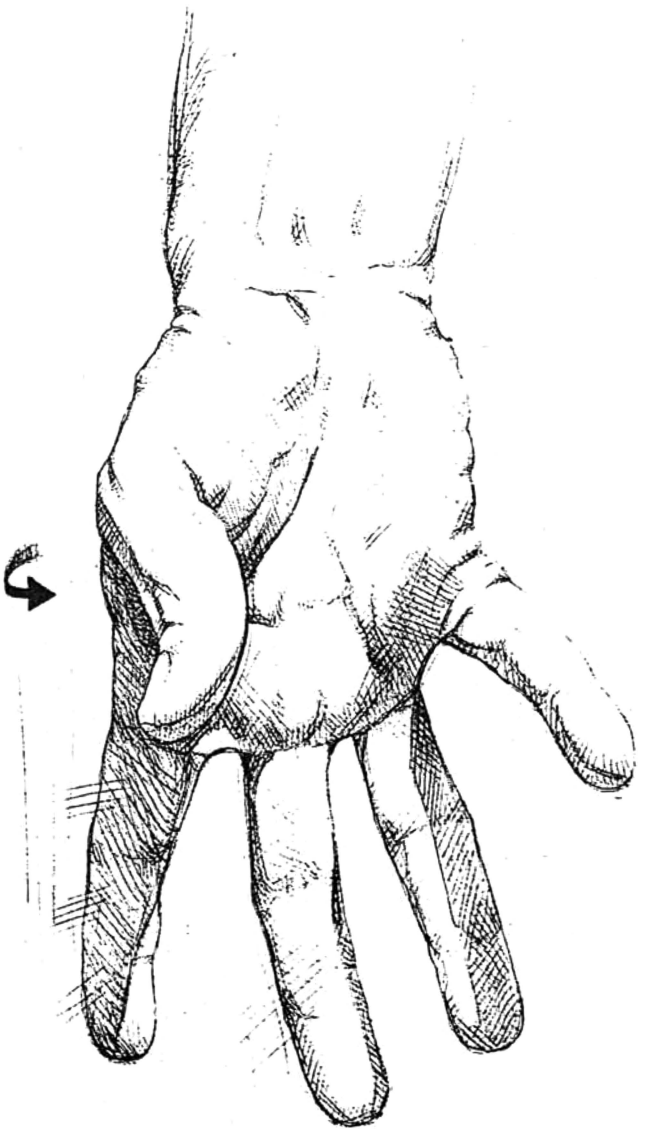
Four muscles found between the tendons of the deep flexor muscles of the fingers (palmar surface of the metacarpals) covered by palmar aponeurosis.

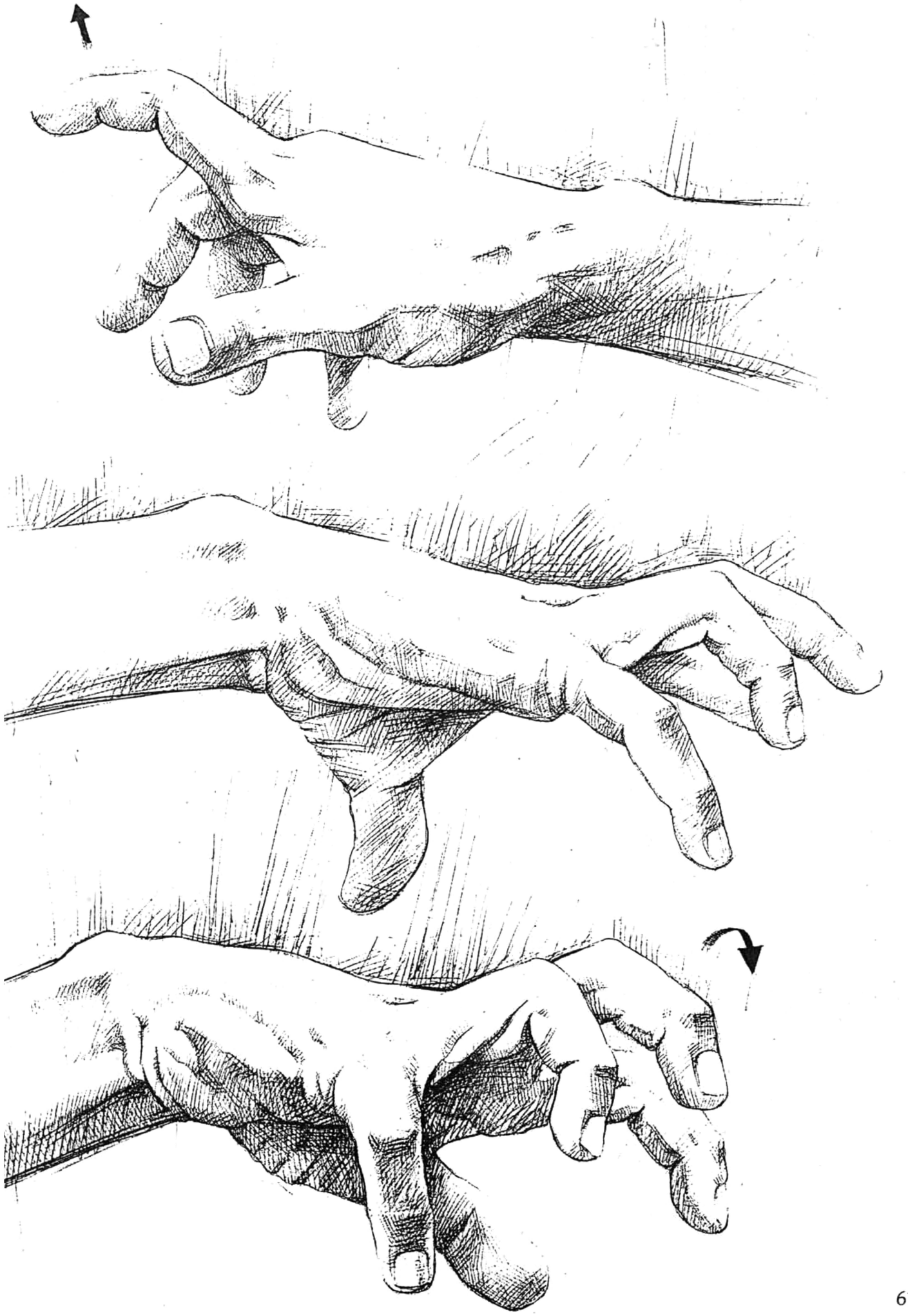
a: flexion of the 1st phalanx of the four fingers, extension of the 2nd and 3rd phalanges

Interossei



o: palmar: palmar surface from 1st, 2nd, 4th, 5th metacarpals; dorsal: dorsal surface of all metacarpals
i: first phalanges of corresponding finger, tendons of flexors and extensors
a: flexors of 1st phalanx: adduction, spreading of fingers





LOWER LIMB MUSCLES

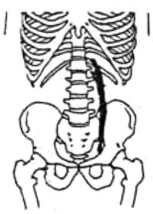
The lower limb is divided into three free parts: the thigh, the leg and the foot, articulated at the level of the hip with the pelvis (formed by the fusion of the ilium, the ischium and the pubis). The functional plane is similar to that of the upper limb.

The thigh is conical, with the larger end at the haunch and the smaller one at the knee; the muscles surrounding the femur are divided into three groups: anterior (extensor), posterior (flexor), medial (adductor). At the level of articulation of the knee is found, anteriorly, the knee-cap (patella). The leg is rounded, with the narrower part nearer the foot. The muscles round the tibia (medially positioned) and the peroneus (laterally) are divided into the anterolateral group (mainly the extensors of the foot) and posterior group (flexors).

The foot is arched (with a transverse flattening) due to the bone structure (tarsus, metatarsus, phalanges). The muscles (plantar and dorsal) are hardly visible: on the dorsal plane of the foot the tendons of the extensor muscles run down.

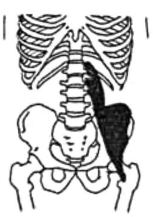
Some of the covering bands of sheathing of the muscles and the mechanics of the large articulations of the limb are important in external morphology, both in the upright position and in dynamic poses.

Psoas Minor



o: 12th thoracic and 1st lumbar vertebrae (lateral surface of the vertebral body)
i: ilium (iliac–pectineal crest), pubis (body of)
a: tendons of the fascia lata, weak flexion of the pelvis on the lumbar vertebrae

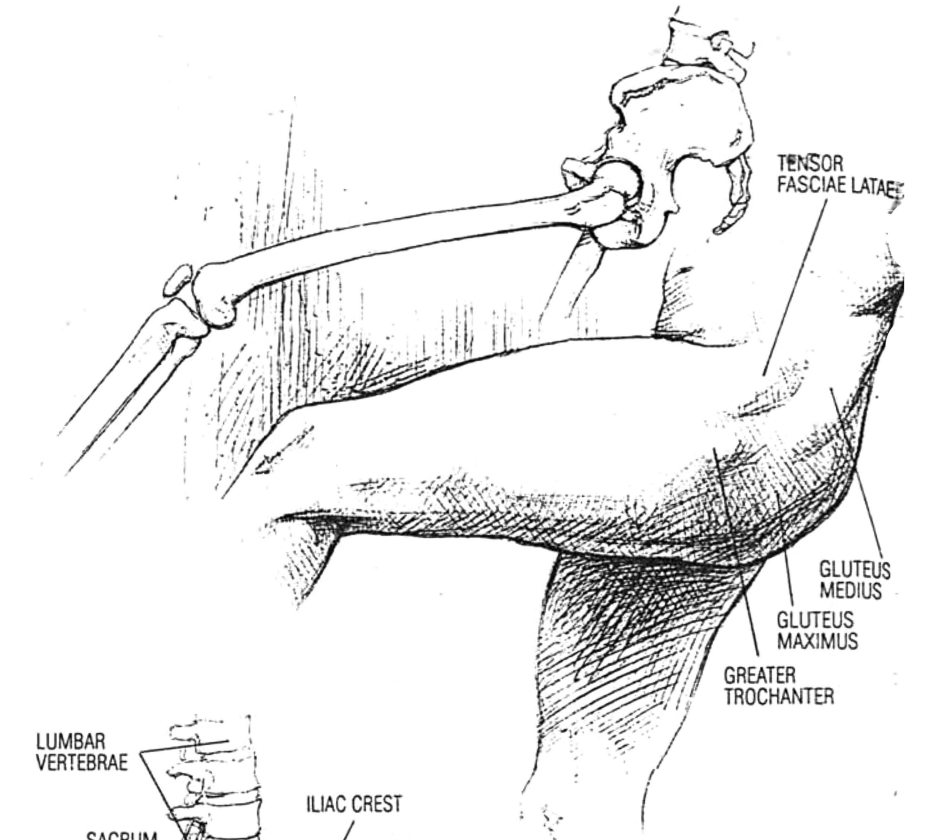
Psoas Major and Iliacus

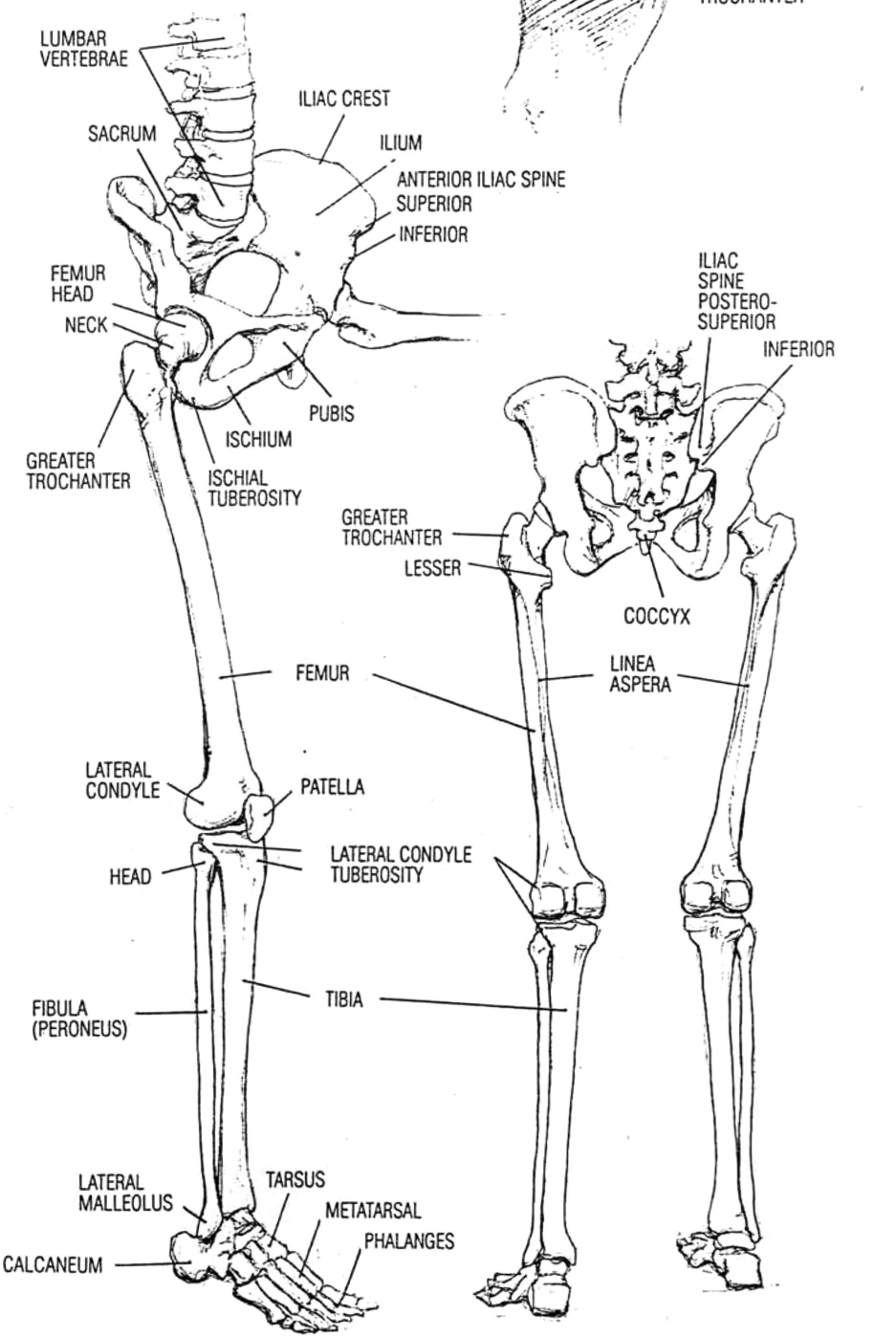


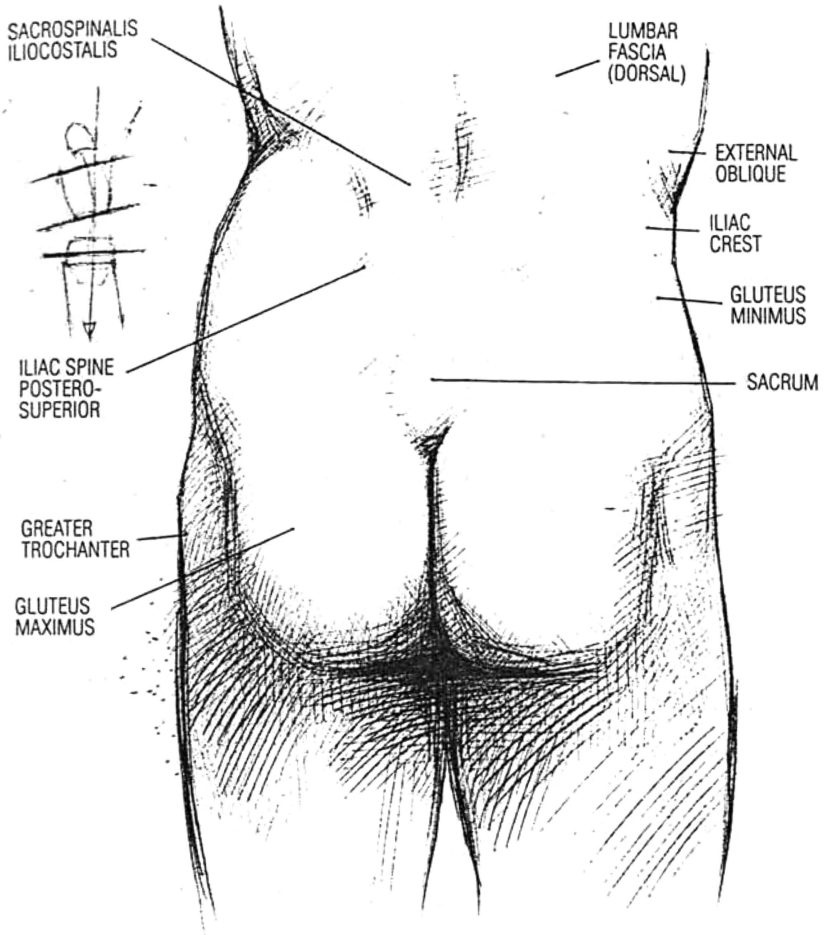
o: vertebrae from the 12th thoracic to the 4th lumbar (vertebral body and transverse costiform process), ilium (inner surface)
i: femur (lesser trochanter)
a: flexion of the thigh on the pelvis (and vice versa); outer rotation of the femur (with adduction and slight flexion); lateral flexion of the spine

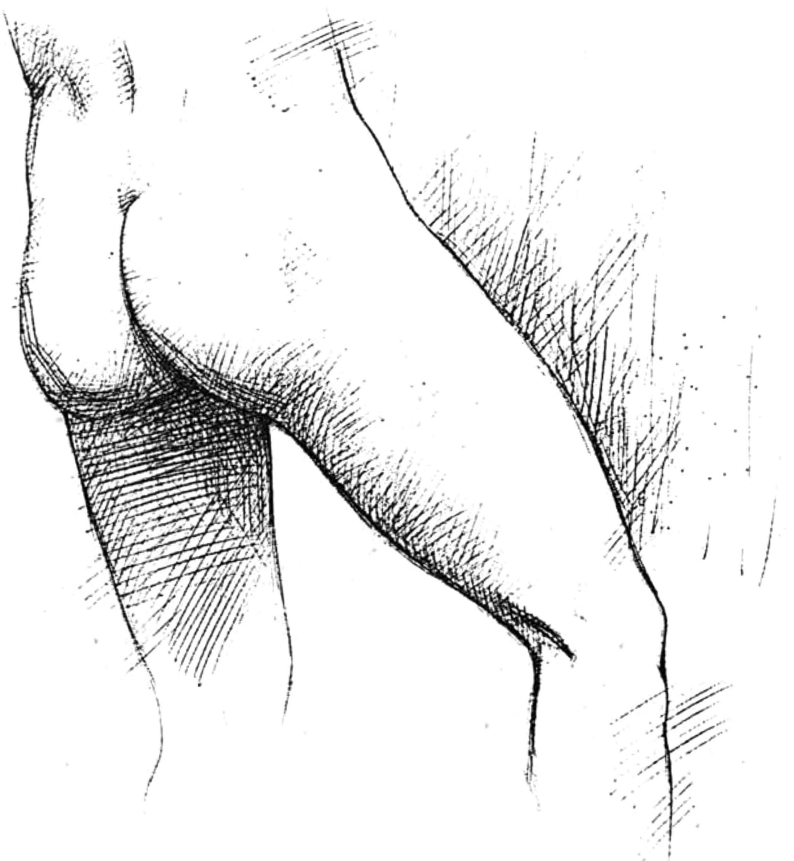
Gluteus Minimus

o: ilium (outer fascia)
i: femur (apex of the greater trochanter)
a: abduction; lateral and medial rotation of the thigh; sideways bending and flexion of the pelvis

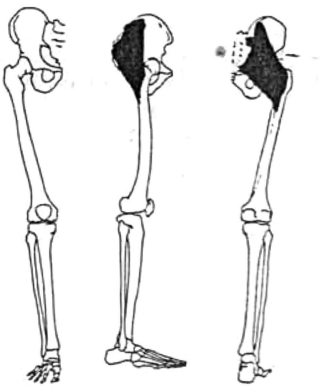








Gluteus Maximus



o: ilium (rear portion of wing and posterior iliac crest)
i: femur (greater trochanter and gluteal tuberosity), fascia lata (iliotibial tract)
a: extension of thigh; adduction and lateral rotation of thigh; extension of pelvis. This muscle is important in walking and in standing upright

Gluteus Medius

o: ilium (external fascia)
i: femur (lateral fascia of the greater trochanter)
a: abduction; lateral and medial rotation of the inward thigh

Tensor Fasciae Latae

o: ilium (anterosuperior iliac spine, external margins of the iliac crest)
i: fascia lata, iliotibial tract
a: tendons of the fascia lata (standing upright); flexion and adduction of the thigh; extension of the leg

Piriformis

o: (bone of) sacrum (anterior surface, from 2nd and 4th foramina)
i: femur (apex of greater trochanter)
a: abduction and outward rotation of thigh

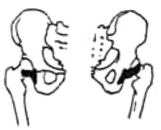
Obturator Internus

o: pubis (ramus, obturator foramen)
i: femur (trochanteric fossa)
a: slight outward rotation of thigh

Gemellus Superior and Inferior

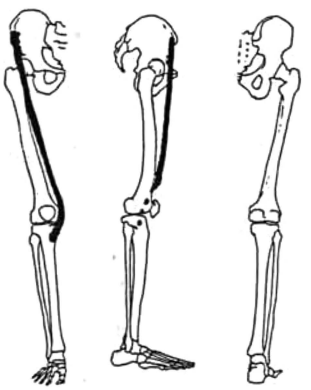
o: ischial spine and tuberosity
i: femur (posterior surface of neck)
a: weak outward rotation of femur

Quadratus Femoris

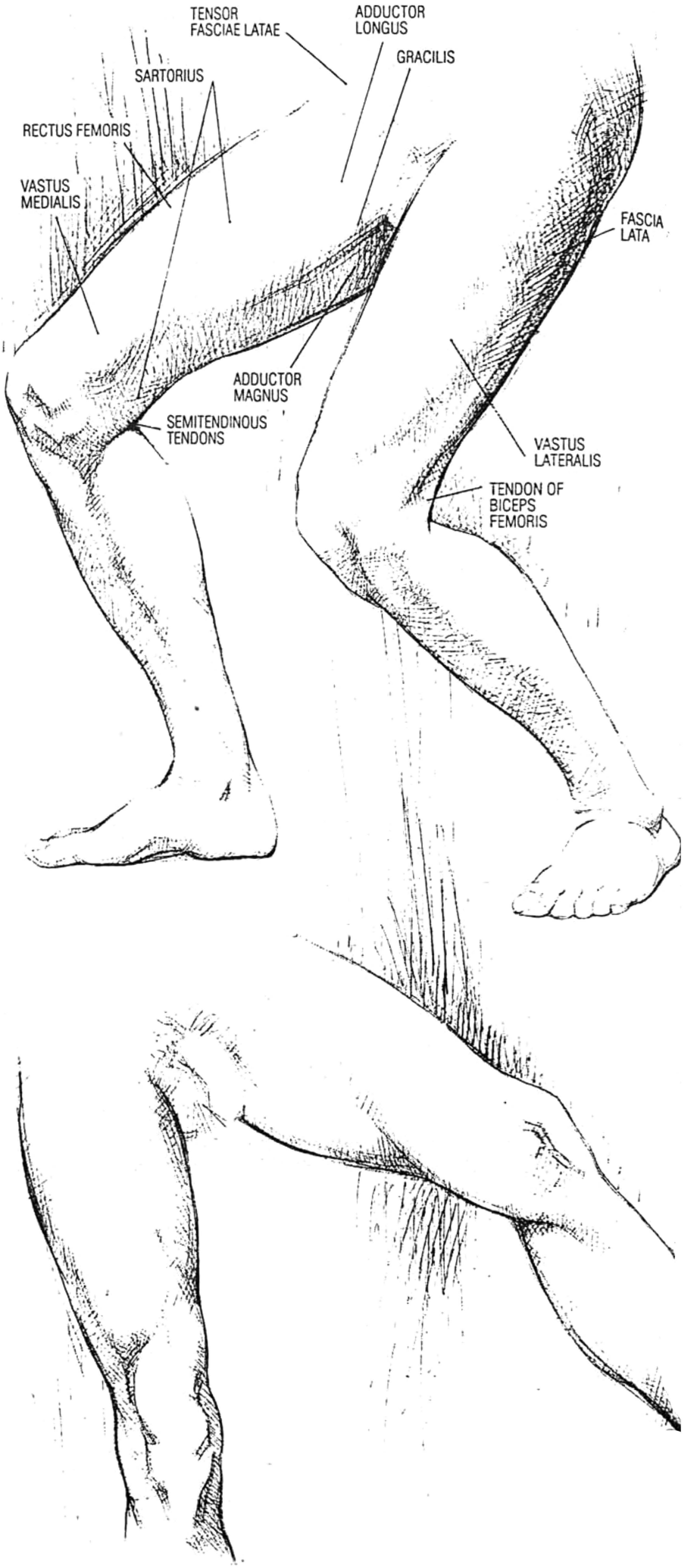


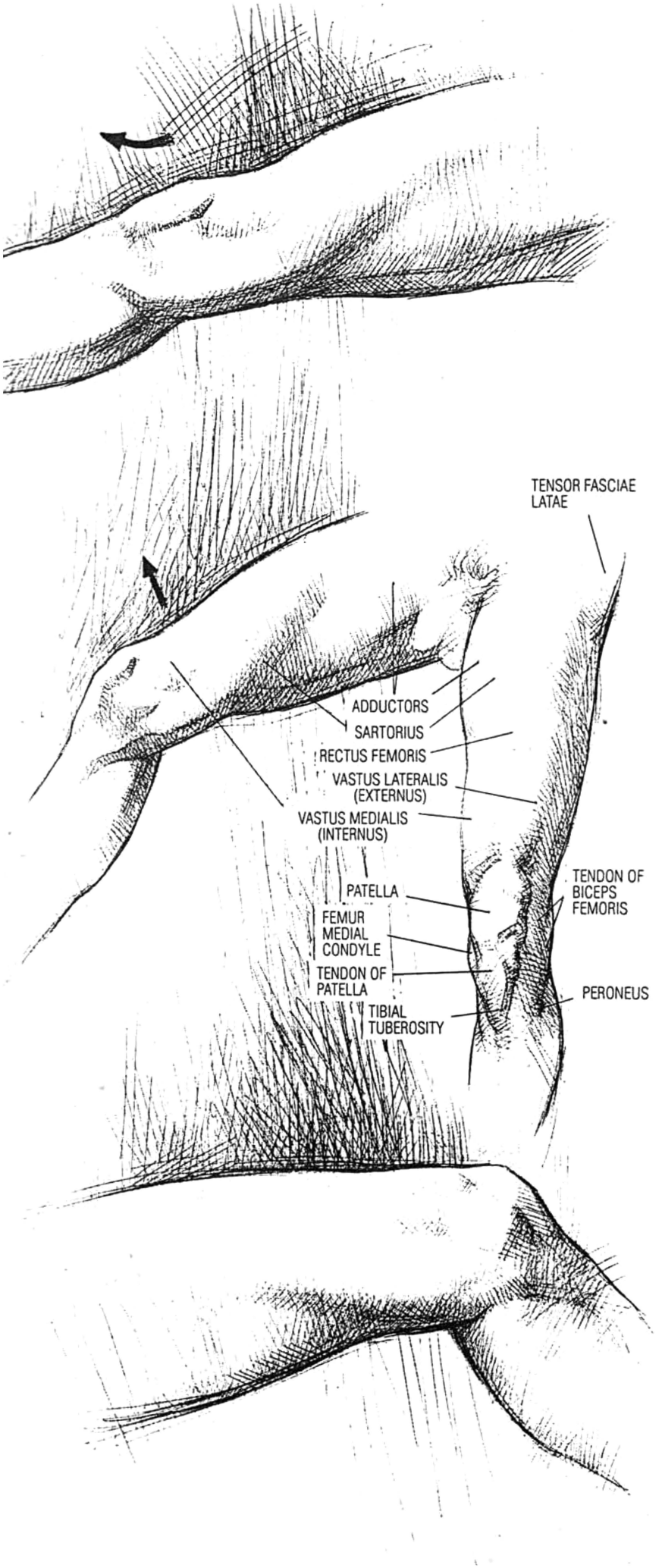
o: ischium (lateral margin of the tuberosity)
i: femur (intertrochanteric crest)
a: weak adduction and outward rotation of thigh

Sartorius



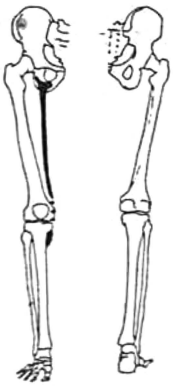
o: ilium (anterosuperior spine)
i: tibia (medial margin of the tuberosity)
a: flexion of leg and thigh; medial rotation of flexed leg





Gracilis

o: pubis (inferior ramus)
i: tibia (medial border of tuberosity)
a: flexion, adduction and outward rotation of leg



Pectineus

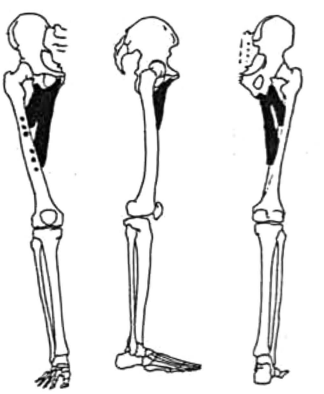
o: pubis (superior ramus)
i: femur (posterior surface, line below lesser trochanter)
a: adduction, flexion, outward rotation of thigh

Adductor Longus

o: pubis (inferior ramus, near symphysis)
i: femur (mid-line of posterior surface; rough medial lip of linea aspera)
a: adduction, flexion, outward rotation of thigh, bending of pelvis over thigh

Adductor Brevis

o: pubis (inferior ramus)
i: femur (superior half of posterior surface: rough medial lip of linea aspera)
a: adduction, lateral rotation of thigh



Quadriceps Femoris

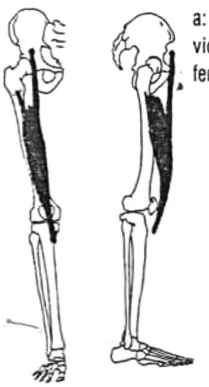
This is formed by four heads meeting in one tendon of insertion.

RECTUS FEMORIS — o: ilium (anteroinferior spine)

VASTUS LATERALIS — o: femur (posterior surface: lateral lips of linea aspera)

VASTUS MEDIALIS — o: femur (posterior surface: medial lips of linea aspera)

VASTUS INTERMEDIUS — o: femur (anterior surface)
i: (joining of four heads): patella and tibia (tuberosity)
a: total: extension of leg on to thigh and vice versa; flexion of thigh (rectus femoris); mechanism of upright stance

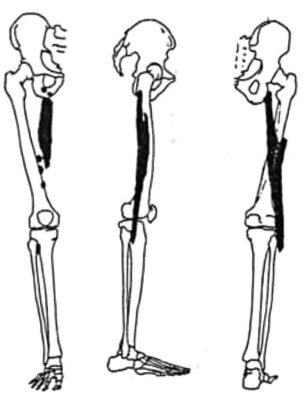


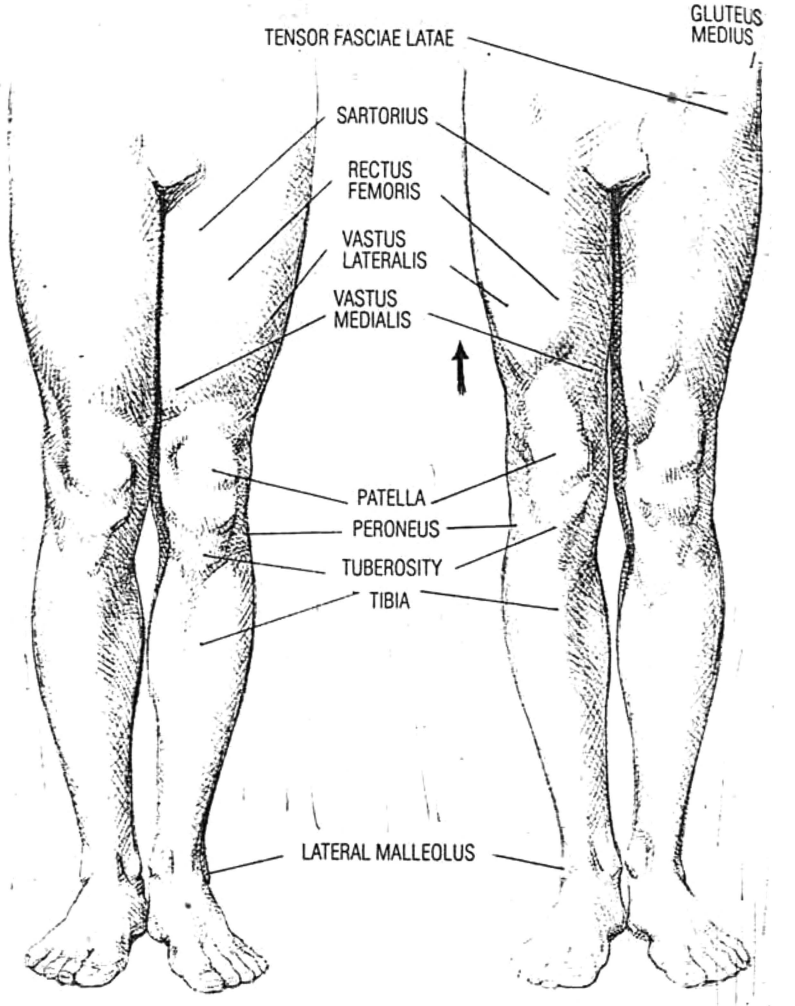
Adductor Magnus

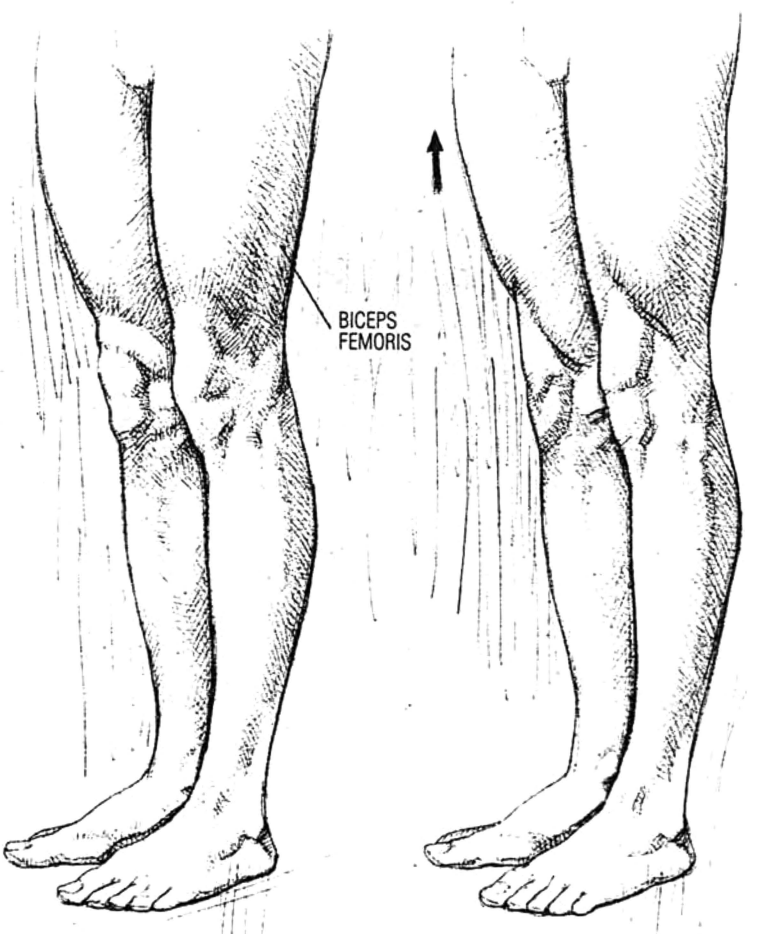
o: ischium (inferior ramus and tuberosity)
i: femur (posterior surface: medial lip of linea aspera) (medial epicondyle)
a: adduction, flexion, extension and lateral rotation of thigh

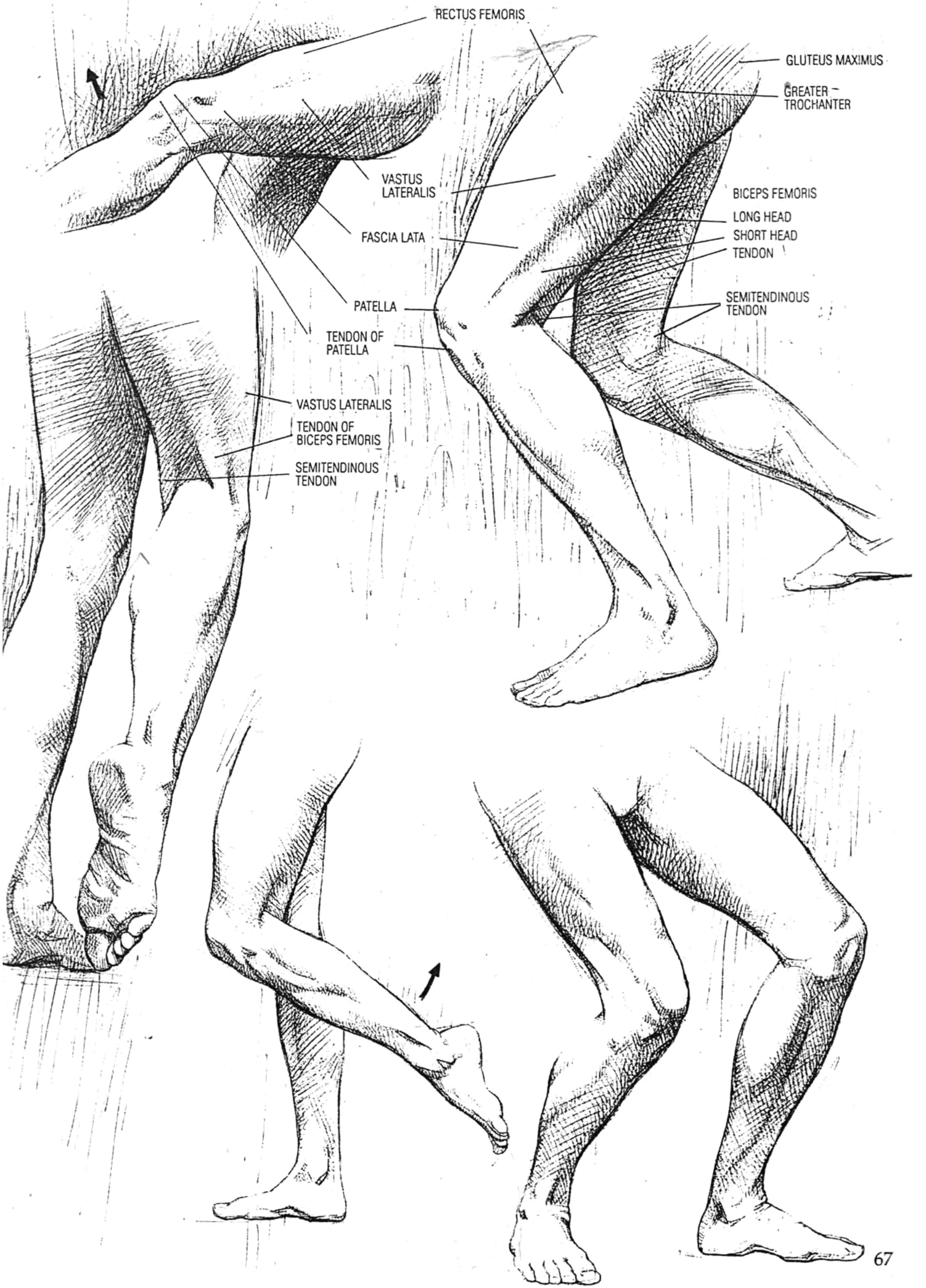
Biceps Femoris

o: long head: ischium (tuberosity); short head: femur (posterior surface: mid-tract of lateral lips of linea aspera)
i: fibula (head)
a: flexion of leg; extension of thigh; outward rotation of the flexed limb





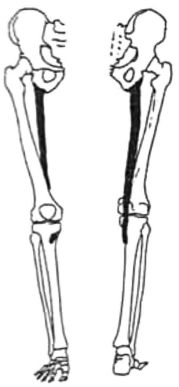



RECTUS FEMORIS
GLUTEUS MAXIMUS
GREATER TROCHANTER
VASTUS LATERALIS
BICEPS FEMORIS
LONG HEAD
SHORT HEAD
TENDON
FASCIA LATA
PATELLA
SEMITENDINOUS TENDON
TENDON OF PATELLA
VASTUS LATERALIS
TENDON OF BICEPS FEMORIS
SEMITENDINOUS TENDON

Obturator Externus

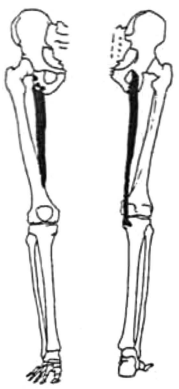
o: pubis (superior and inferior ramus)
i: femur (trochanteric fossa)
a: outward rotation of femur

Semitendinosus



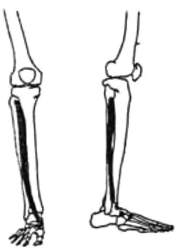
o: ischium (tuberosity)
i: tibia (medial edge of tuberosity)
a: flexion of leg (with inner rotation), extension of thigh

Semimembranosus



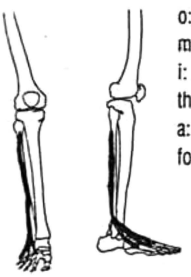
o: ischium (tuberosity)
i: tibia (posterior side of medial condyle)
a: flexion of leg; extension of thigh

Tibialis Anterior

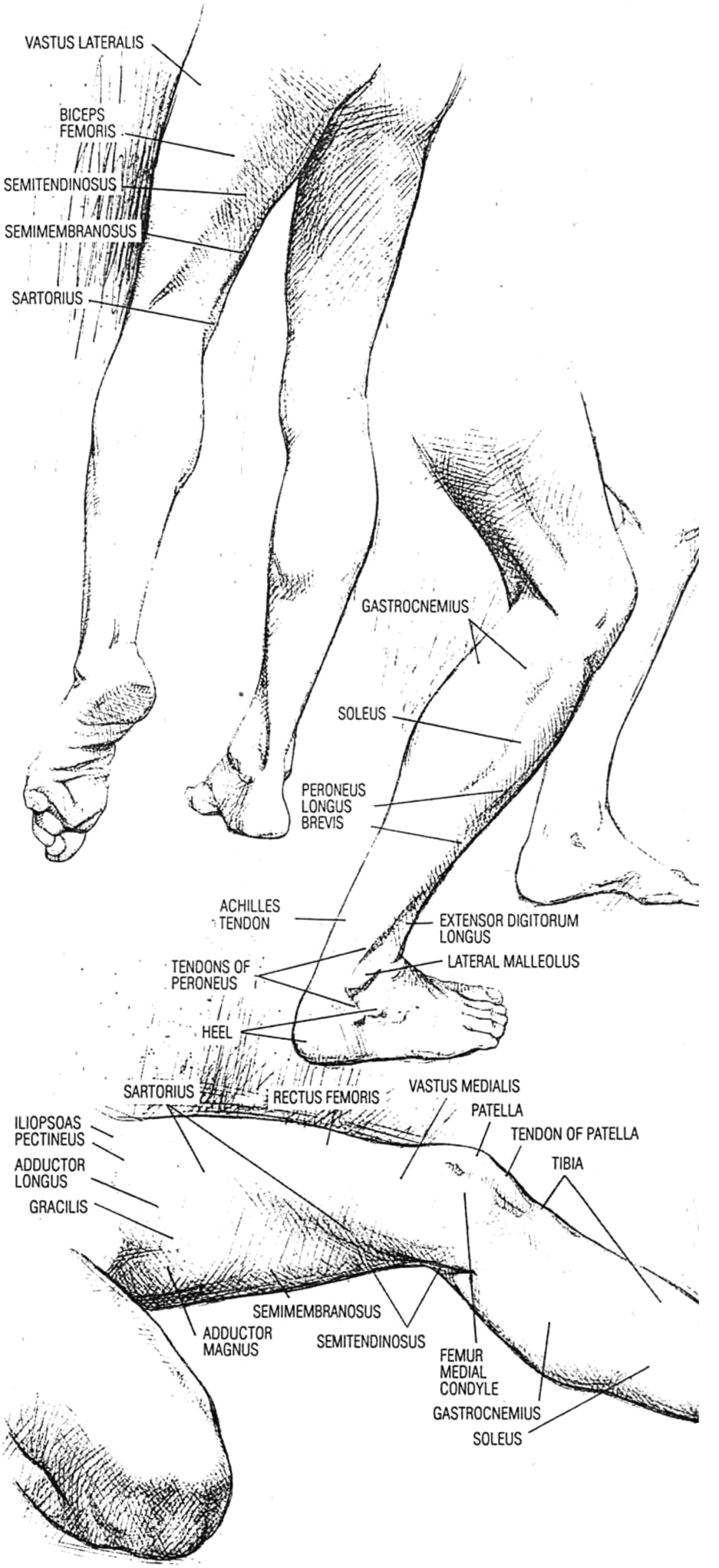


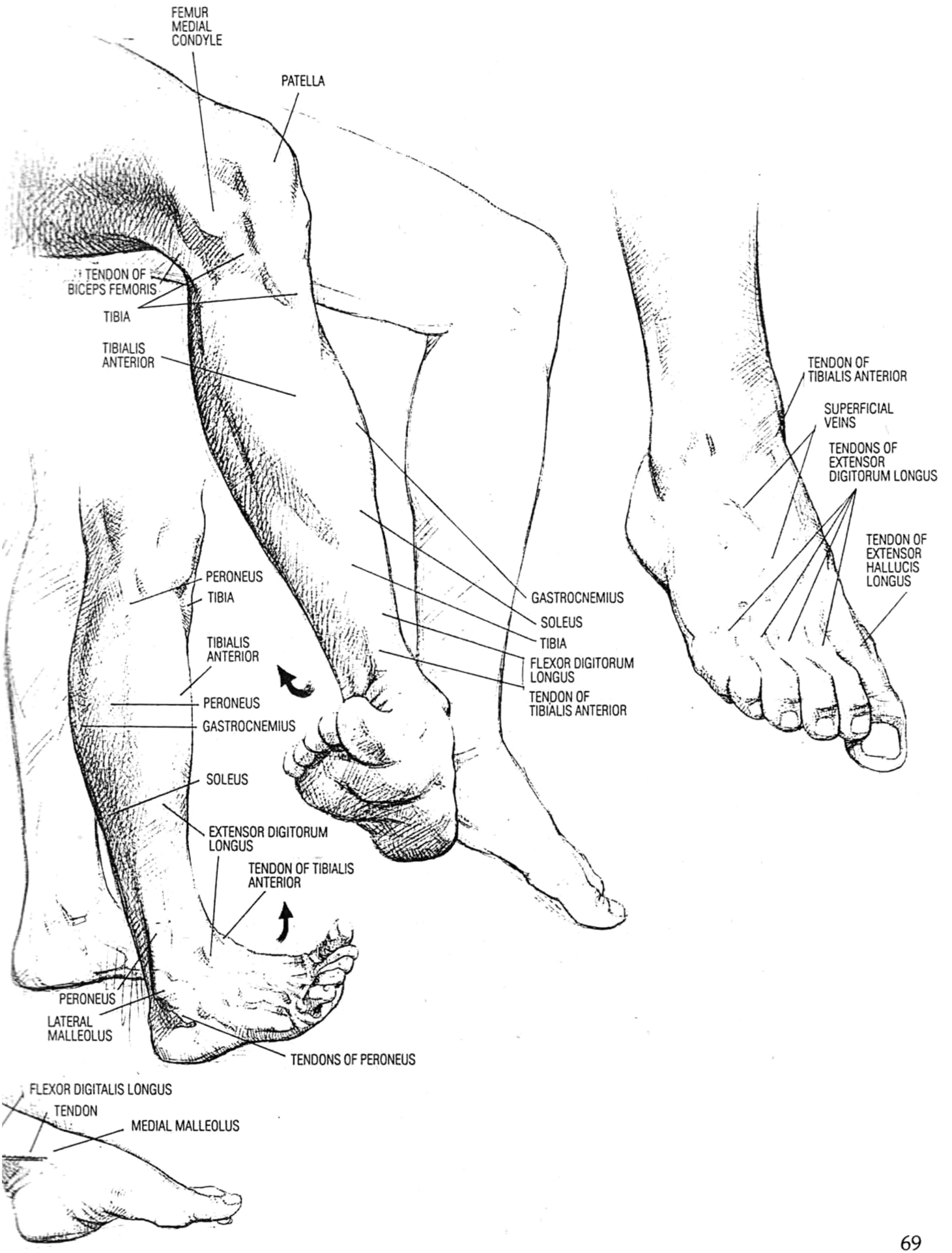
o: tibia (lateral condyle and superior tract of lateral side)
i: 1st metatarsal (plantar side of base), first cuneiform
a: dorsal flexion of foot with inner rotation; slight adduction of foot

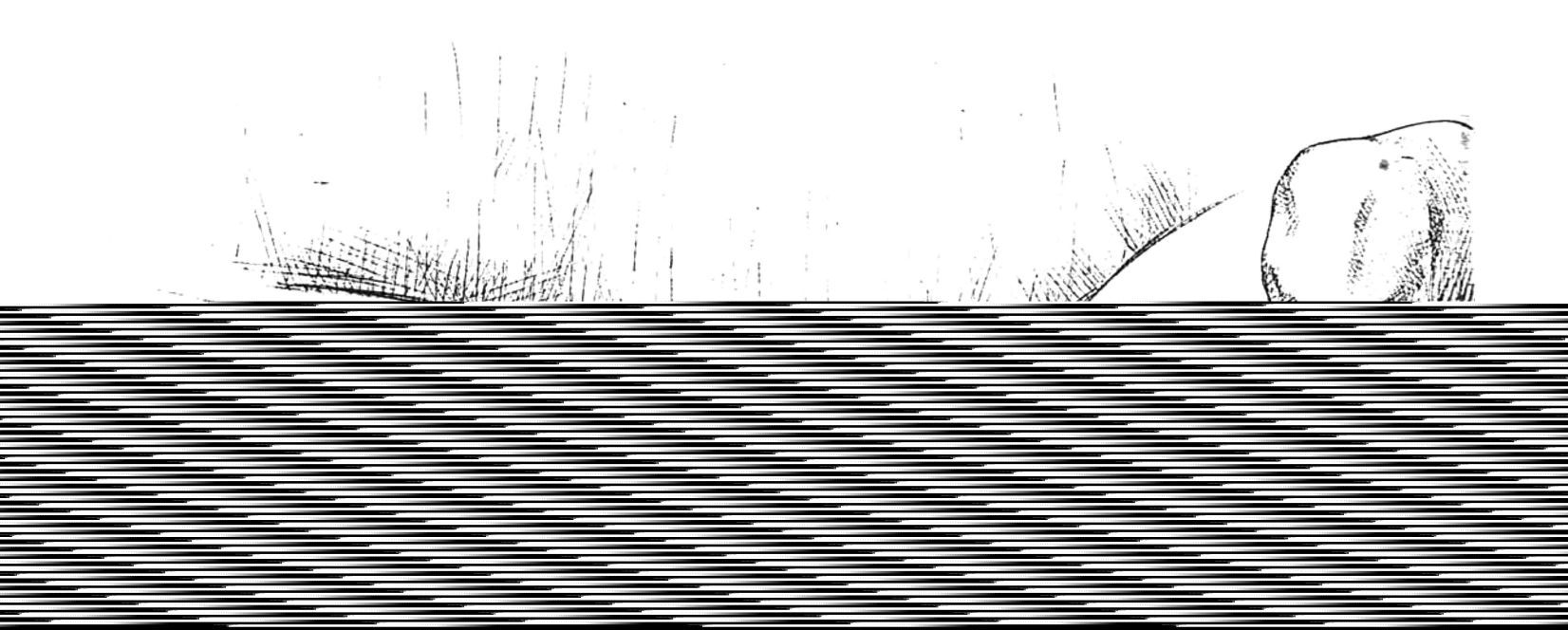
Extensor Digitorum Longus

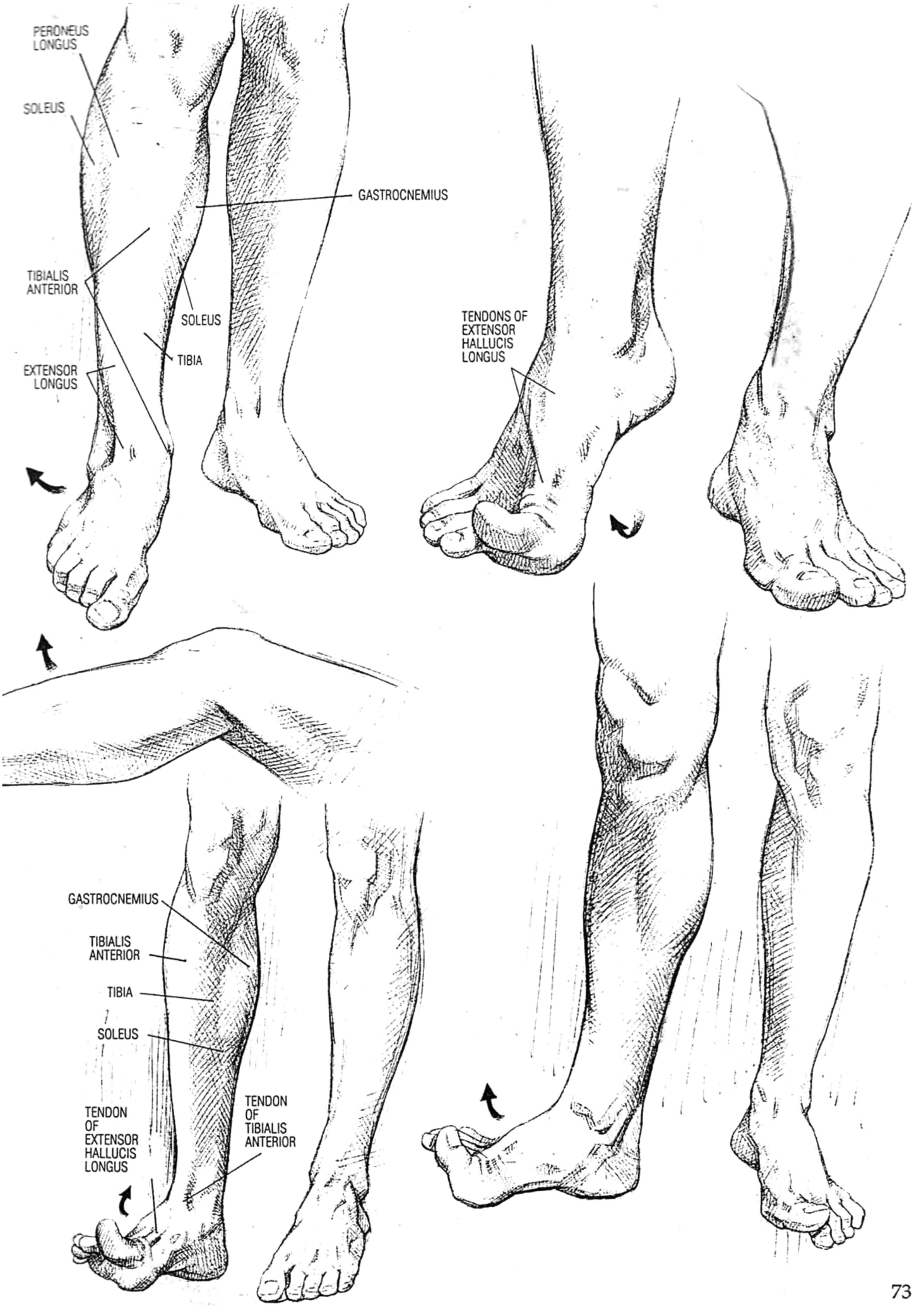


o: tibia (lateral condyle), fibula (anterior margin), interosseous membrane
i: with four tendons to the dorsal side of the four toes (except the great toe)
a: extension of toes; dorsal flexion of foot



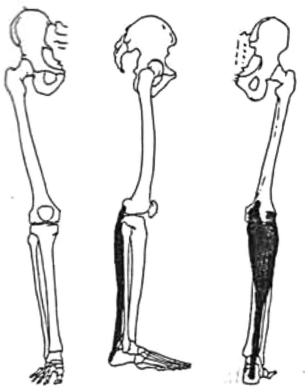

FEMUR
MEDIAL
CONDYLE
PATELLA
TENDON OF
BICEPS FEMORIS
TIBIA
TIBIALIS
ANTERIOR
PERONEUS
TIBIA
TIBIALIS
ANTERIOR
PERONEUS
GASTROCNEMIUS
SOLEUS
EXTENSOR DIGITORUM
LONGUS
TENDON OF TIBIALIS
ANTERIOR
PERONEUS
LATERAL
MALLEOLUS
TENDONS OF PERONEUS
GASTROCNEMIUS
SOLEUS
TIBIA
FLEXOR DIGITORUM
LONGUS
TENDON OF
TIBIALIS ANTERIOR
TENDON OF
TIBIALIS ANTERIOR
SUPERFICIAL
VEINS
TENDONS OF
EXTENSOR
DIGITORUM LONGUS
TENDON OF
EXTENSOR
HALLUCIS
LONGUS
FLEXOR DIGITALIS LONGUS
TENDON
MEDIAL MALLEOLUS




PERONEUS LONGUS
SOLEUS
GASTROCNEMIUS
TIBIALIS ANTERIOR
SOLEUS
TIBIA
EXTENSOR LONGUS
TENDONS OF EXTENSOR HALLUCIS LONGUS
GASTROCNEMIUS
TIBIALIS ANTERIOR
TIBIA
SOLEUS
TENDON OF EXTENSOR HALLUCIS LONGUS
TENDON OF TIBIALIS ANTERIOR

Gastrocnemius

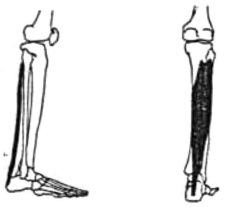
The superficial part of the triceps of the calf.



o: middle or long head: femur (medial epicondyle); short head: femur (lateral epicondyle)
i: heel (tuberosity, Achilles tendon)
a: plantar flexion of foot; flexion of leg; abduction of foot (the complex action is very important in walking and standing upright)

Soleus

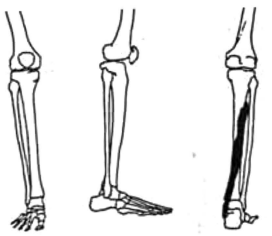
This is the deepest part of the triceps muscle of the calf; the superficial part is the gastrocnemius.
o: tibia (superior tract of posterior side), fibula (head and superior tract of posterior side)
i: heel (tuberosity, posterior side, for the passage of the common tendons of the triceps; Achilles heel)
a: extension (plantar flexion) of foot



Popliteus

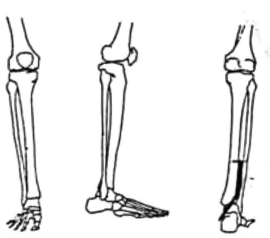
o: femur (lateral condyle)
i: tibia (superior tract of posterior side)
a: flexion of leg (with medial rotation)

Flexor Digitorum Longus

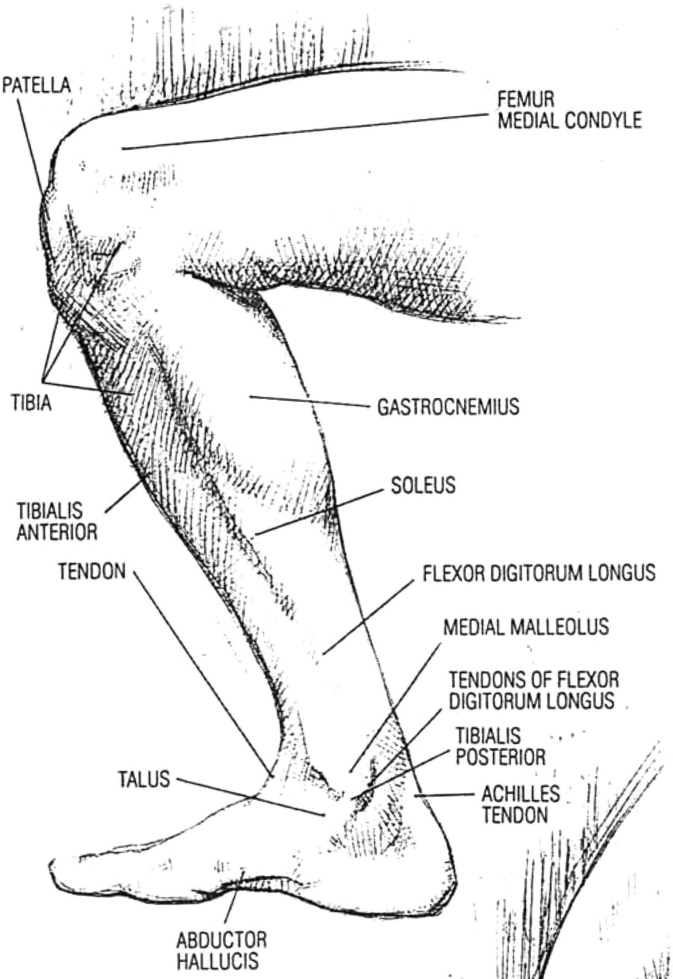


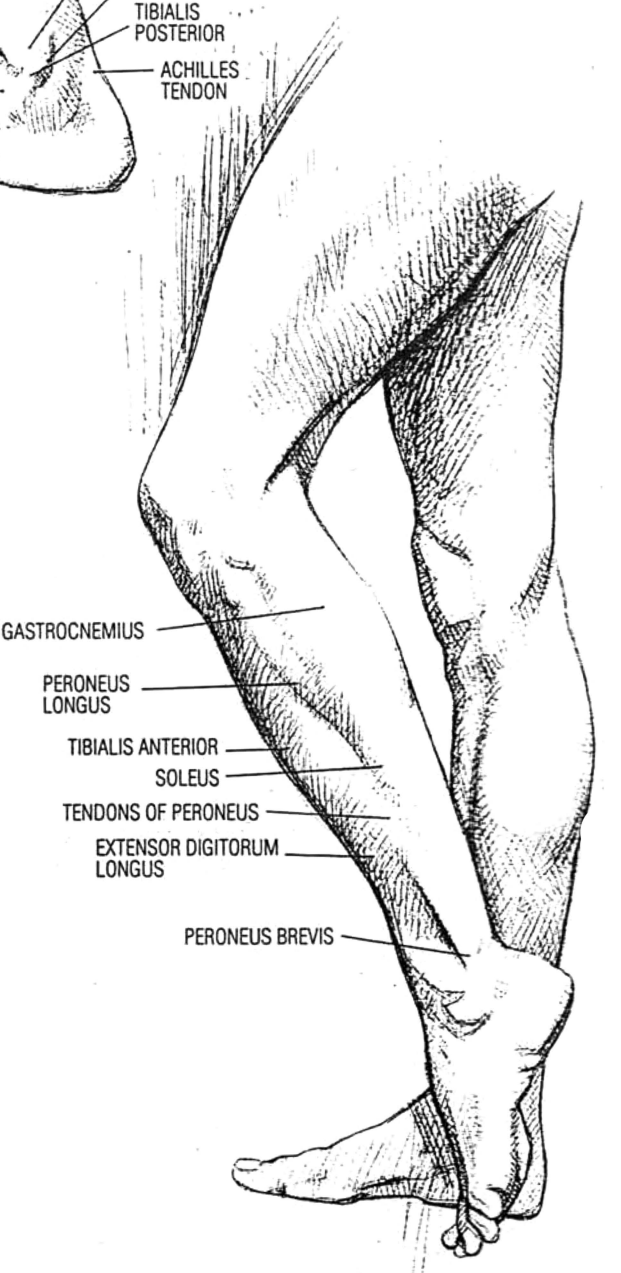
o: tibia (middle tract of posterior side)
i: last phalanx of the four toes (excluding the great toe)
a: flexion of toes and sole of foot; adduction of foot

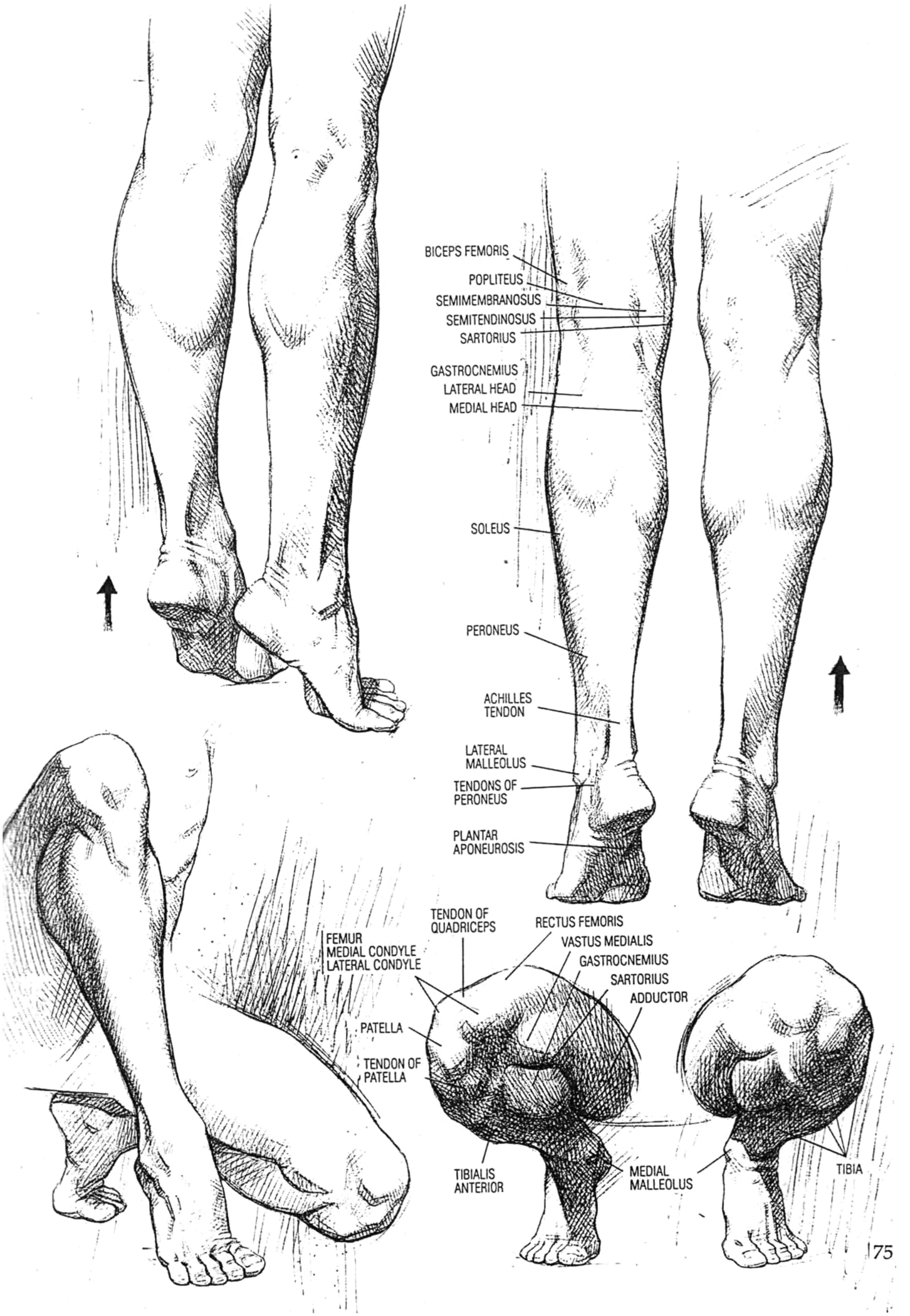
Flexor Hallucis Longus



o: fibula (middle tract of posterior side)
i: last phalanx of the great toe, plantar side
a: flexion of great toe and sole of foot; adduction of foot





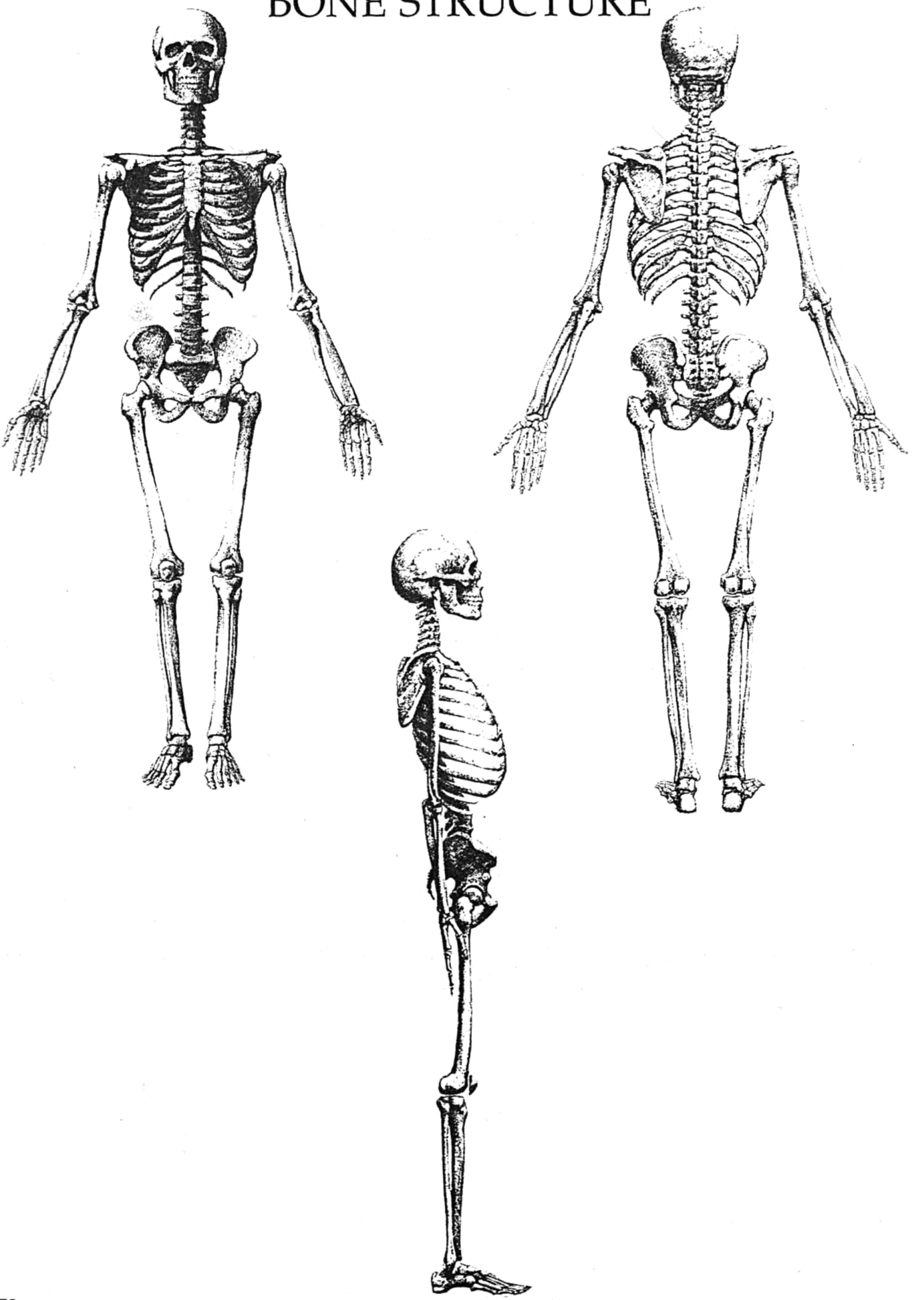

BICEPS FEMORIS
POPLITEUS
SEMIMEMBRANOSUS
SEMITENDINOSUS
SARTORIUS
GASTROCNEMIUS
LATERAL HEAD
MEDIAL HEAD
SOLEUS
PERONEUS
ACHILLES TENDON
LATERAL MALLEOLUS
TENDONS OF PERONEUS
PLANTAR APONEUROSIS
FEMUR
MEDIAL CONDYLE
LATERAL CONDYLE
TENDON OF QUADRICEPS
RECTUS FEMORIS
VASTUS MEDIALIS
GASTROCNEMIUS
SARTORIUS
ADDUCTOR
PATELLA
TENDON OF PATELLA
TIBIALIS ANTERIOR
MEDIAL MALLEOLUS
TIBIA

Tibialis

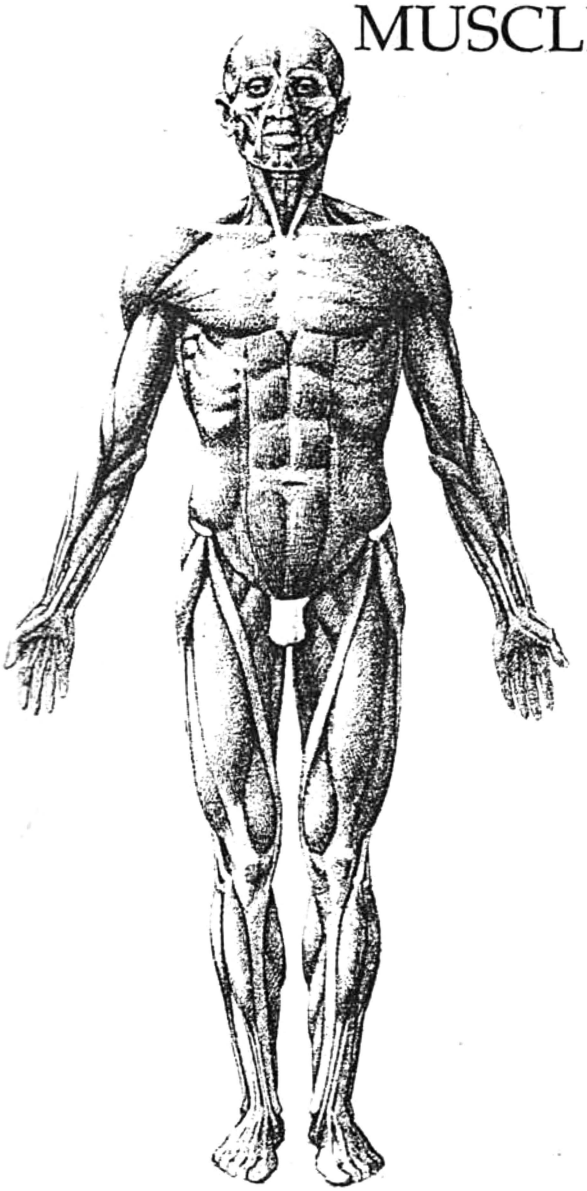
o: tibia (shin) (middle tract of posterior side), interosseous membrane
i: navicular bone, cuneiform bones, plantar surface of 2nd to 4th metatarsals
a: flexes ankle [illegible]

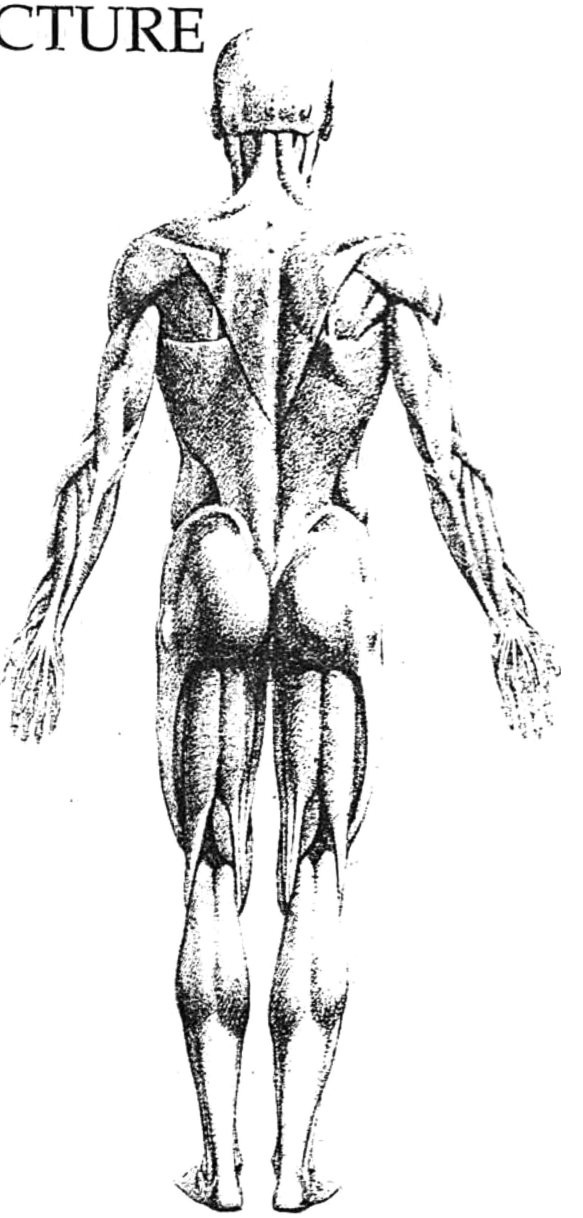
TENDONS OF

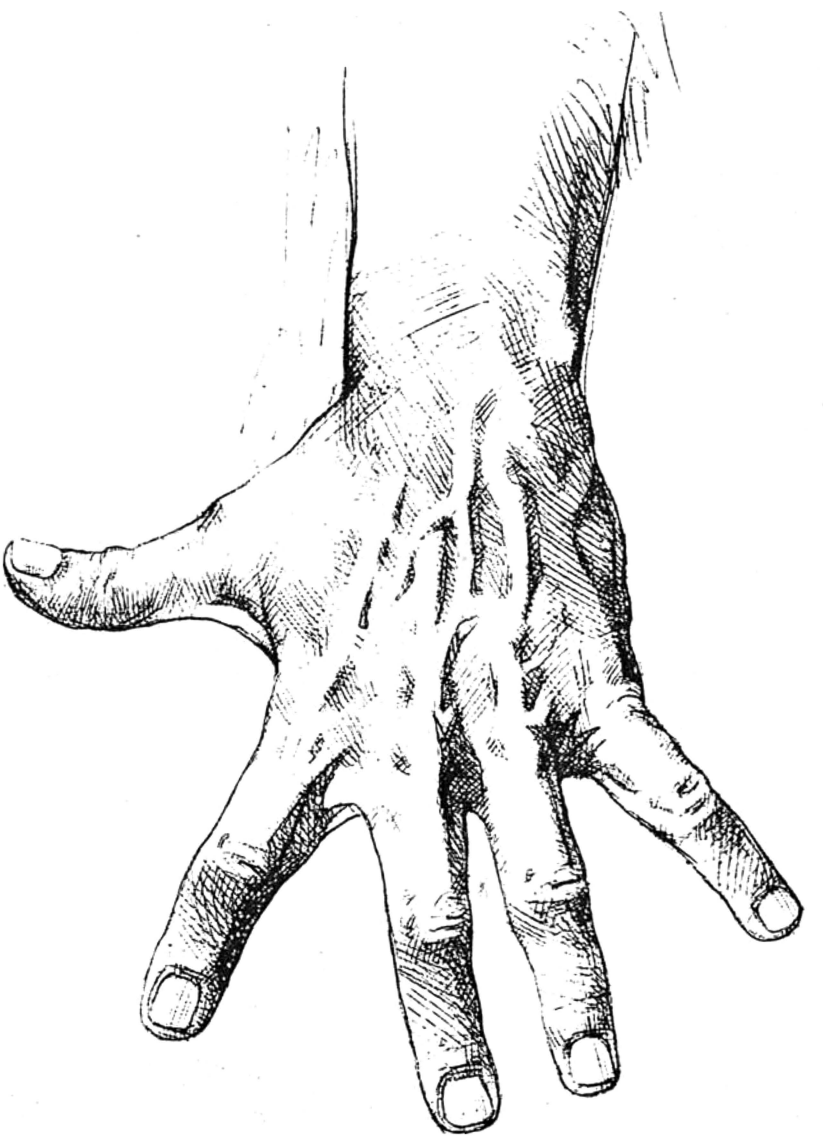
BONE STRUCTURE



MUSCLE STRUCTURE







THE LOCOMOTOR APPARATUS

Trunk

TORSO

Osteology

Spine: 7 cervical vertebrae
12 thoracic vertebrae
5 lumbar vertebrae
5 sacral vertebrae
3 coccygeal vertebrae

Arthrology

Articulations between the vertebral bodies
Articulations between the articulatory processes
Longitudinal ligaments (ant. and post.)
of the spine
Ligaments between the vertebral arches
interlaminary ligaments
intertransverse ligaments
interspinous ligaments
Craniovertebral articulations

Myology

Muscles of the vertebral sulci
1 Superficial: (sacrospinal)
(a) iliocostalis
(b) longissimus

2 Intermediary
(a) spinalis
(b) transverse–spinal
(i) semispinalis
(ii) multifidus
(iii) rotatores
(c) splenius
(i) splenius cervicis
(ii) splenius capitis

3 Deep
(a) interspinous
(b) intertransverse
(c) suboccipital
(i) small pectus post.
(ii) large pectus post.
(iii) inferior oblique
(iv) superior oblique

Ventral musculature of the vertebral column
1 Prevertebral muscles
(a) longus cervicis
(b) longus capitis
(c) anterior and lateral rectus

2 Sacrococcygeal musculature

Muscular fasciae

nuchal fascia
lumbar–dorsal fascia

NECK

Osteology

hyoid bone
cartilages of the larynx

Myology

Scalenus muscles
1 scalenus anterior
2 scalenus medius
3 scalenus posterior

Sternocleidomastoid muscles

Suprahyoid muscles
1 digastric
2 stylohyoid
3 mylohyoid
4 geniohyoid

Infrahyoid muscles
1 sternohyoid
2 mylohyoid
3 sternothyroid
4 thyrohyoid

Muscular fasciae

medial cervical fascia
deep cervical fascia

THORAX

Osteology

12 ribs
10 costal cartilages
sternum

Myology

Intercostal musculature
1 external intercostal muscles
2 levatores costarum
3 internal intercostal muscles
4 subcostal
5 transversus thoracis

Spinocostal muscles
1 serratus posterior superior
2 serratus posterior inferior

Diaphragm

Arthrology

Costovertebral articulations
1 from head of rib to vertebral body
2 between the costal tubercle and the transverse process

Sternocostal articulations

ABDOMEN

Osteology

Pelvis (hip-bone)
- ischium
- ilium
- pubis

Arthrology

- sacroiliac articulation
- symphysis pubis
- ligaments of pelvis

Myology

Lumbar vertebral musculature
1 quadratus lumborum

Rectus anterior musculature
1 rectus abdominis
2 pyramidalis

Broad lateral abdominal muscles
1 external oblique
2 internal oblique
3 transversus abdominis

Muscle fasciae

Fascia of external oblique
- transverse fascia
- sheath of rectus muscle
- inguinal ligament, etc.

PERINEUM

Myology

Pelvic diaphragm
1 ischium
2 external anal sphincter
3 supporting fasciae

Muscles and fasciae of the perineum
1 sphincter urethrae
2 muscles of the genital region

Head

Osteology

Cranium

Cranial vault
1 occipital bone
2 sphenoid bone
3 frontal bone
4 temporal bone
5 parietal bone

Facial block
1 nasal region
(a) ethmoid
(b) nasal bone
(c) lacrimal bone
(d) vomer
2 maxillary region
(a) maxilla
(b) palatine bone
(c) zygomatic bone
(d) mandible

Arthrology

Sutural articulations
1 coronal suture
2 sagittal suture
Temporomandibular articulation

Myology

Masticatory muscles
1 temporal
2 masseter
3 lateral pterygoid
4 medial pterygoid

Accessory muscular fasciae
1 temporal fascia
2 parotidean fascia
3 Bichat's fat-pad

Mimesis musculature

1 platysma

2 muscles of the region of the mouth
(a) pertaining to the lower lip
(i) triangularis
(ii) quadratus labii inferioris
(iii) incisor of the lower lip
(b) pertaining to the upper lip
(i) zygomaticus
(ii) quadratus labii superioris
(iii) caninus
(iv) incisor
(v) buccinator
(vi) orbicularis oris
(vii) muscles of the chin

3 Muscles of the nose

4 Muscles of the region of the eyes
(a) orbicularis oculi
(b) corrugator muscle of the eyebrows
Epicranial muscle (frontal and occipital)
Muscles of the auricle

Upper Limb

Osteology

Shoulder girdle
clavicle
scapula

Arm
humerus

Forearm
radius
ulna

Hand
carpals (eight bones)
metacarpals (five bones)
phalanges

Arthrology

Articulations of the shoulder girdle
1 acromioclavicular
2 sternoclavicular

Articulations of the free part
1 scapulohumeral
2 elbow
3 radiocarpal
4 radioulnar distal

Articulations of the hand
1 mid-carpal
2 carpometacarpal
3 phalanges of metacarpals
4 interphalangeal joints, etc.

Myology

Axio-appendicular muscles

1 Thoracic–appendicular muscles
(a) 1st layer
(i) pectoralis major
(b) 2nd layer
(i) subclavian
(ii) pectoralis minor
(c) 3rd layer
(i) serratus anterior

2 Spinous appendicular muscles
(a) superficial level
(i) trapezius
(ii) latissimus dorsi
(b) deep level
(i) elevator of scapula
(ii) rhomboid

Muscles of the upper limb

1 Muscles of the shoulder
(a) deltoid
(b) subscapular
(c) supraspinatus
(d) subspinatus
(e) teres minor
(f) teres major

2 Muscles of the arm
(a) anterior upper arm muscles (flexors)
(i) biceps
(ii) coracobrachialis
(iii) brachialis
(b) posterior upper arm muscles (extensors)
(i) triceps
(ii) anconeus

3 Muscles of the forearm
(a) anterior forearm muscles (flexors)
(i) pronator teres
(ii) flexor carpi radialis
(iii) palmaris longus
(iv) flexor carpi ulnaris
(v) flexor digitorum profundus (of the epicondyle)
(i) brachioradialis
(ii) extensor carpi radialis longus (deep muscles)
(i) flexor digitorum profundus
(ii) flexor pollicis longus
(iii) pronator quadratus
(b) posterior forearm muscles (extensors)
(superficial muscles)
(i) extensors of the fingers
(ii) extensor digiti minimi
(iii) extensor carpi ulnaris (deep muscles)
(i) supinator
(ii) abductor pollicis longus
(iii) extensor pollicis brevis
(iv) extensor pollicis longus
(v) extensor indicis

4 Muscles of the hand
(a) thenar group
(i) abductor pollicis brevis
(ii) flexor pollicis brevis
(iii) opponens pollicis brevis
(iv) adductor pollicis brevis
(b) hypothenar
(i) abductor digiti minimi
(ii) flexor digiti minimi brevis
(iii) opponens digiti minimi
(c) central muscles of the hand
(i) lumbricals (four)
(ii) palmar interossei (four)
(iii) dorsal interossei (four)

Muscular fasciae

single fascia divided topographically: shoulder, arm, etc.
ligaments and sheaths of tendons

Lower Limb

Osteology

1 Pelvic girdle: pelvis

2 Bones of the thigh
(a) femur
(b) patella

3 Bones of the leg
(a) tibia
(b) fibula

4 Bones of the foot
(a) tarsal bones
(i) talus
(ii) calcaneum
(iii) navicular
(iv) cuneiform
(v) cuboid
(b) metatarsals (five bones)
(c) phalanges

Arthrology

1 Articulations of the pelvic girdle (pelvis)
2 Articulations of the free part
(a) coxa (hip joint)
(b) knee
(c) tarsotibial
(d) tibiofibular

3 Articulations of the foot (with various ligaments)
(a) talocalcanean
(b) metatarsophalangeal

Myology

1 Spinoappendicular muscles
(a) psoas minor
(b) psoas major

2 Muscles of the gluteal region
(a) gluteus maximus
(b) tensor fasciae latae
(c) gluteus medius
(d) gluteus minimus
(e) piriformis
(f) obturator internus
(g) gemellus superior/inferior
(h) quadratus femoris

3 Muscles of the thigh
(a) anterior muscles
(i) sartorius
(ii) quadriceps
rectus femoris
vastus medialis
vastus lateralis
vastus intermedius
(iii) articulation of the knee
(b) medial femoral group
(i) pectineus
(ii) adductor longus
(iii) adductor brevis
(iv) gracilis
(v) adductor magnus and minimus
(vi) obturator externus
(c) posterior femoral group
(i) biceps femoris
(ii) semitendinosus
(iii) semimembranosus

4 Muscles of the leg
(a) anterior muscles
(i) tibialis anterior
(ii) extensor digitorum longus
(iii) peroneus tertius
(iv) extensor hallucis longus
(b) lateral muscles
(i) peroneus longus
(ii) peroneus brevis
(c) posterior muscles
(i) triceps surae
gastrocnemius
soleus
(ii) plantar muscle
(iii) popliteus
(iv) flexor digitorum longus
(v) tibialis posterior
(vi) flexor hallucis longus

5 Muscles of the foot
(a) dorsal muscles

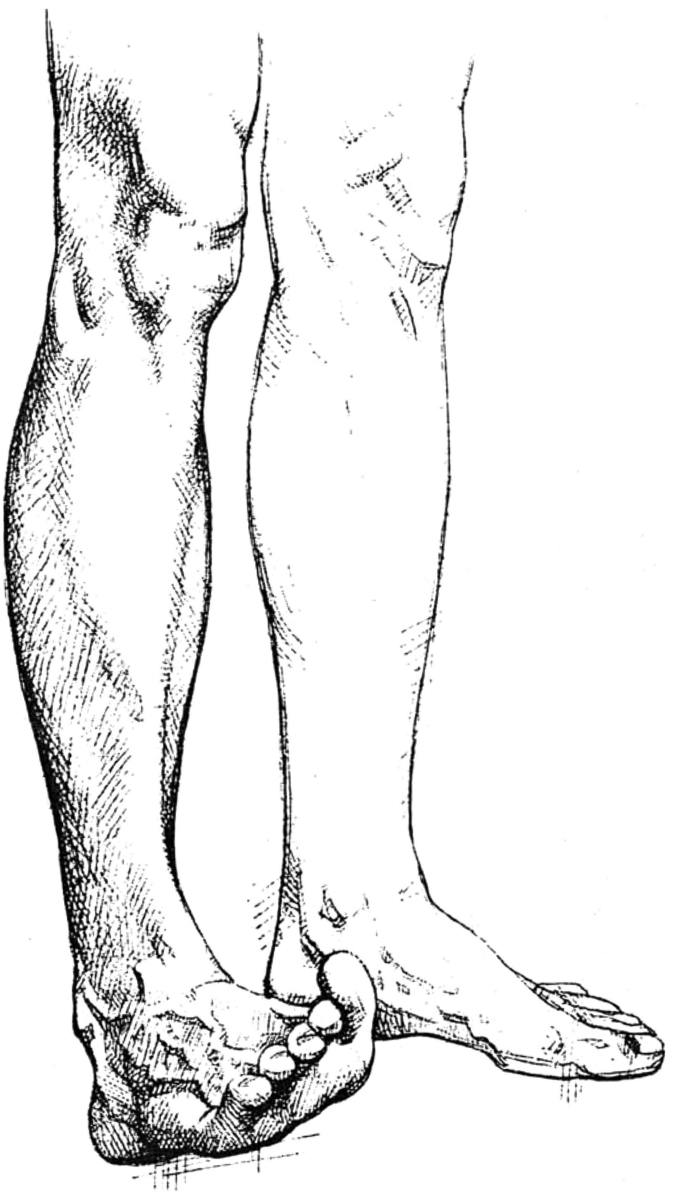
(i) extensor digitorum brevis
(b) plantar muscles

(i) medial
abductor hallucis
flexor hallucis brevis
adductor brevis

(ii) lateral
abductor V digitorum
flexor brevis V digitorum
opponens V digitorum

(iii) central
flexor digitorum brevis
quadratus digitorum
lumbricals and interossei

Muscular fasciae
single fascia topographically divided
ligaments and sheaths of tendons



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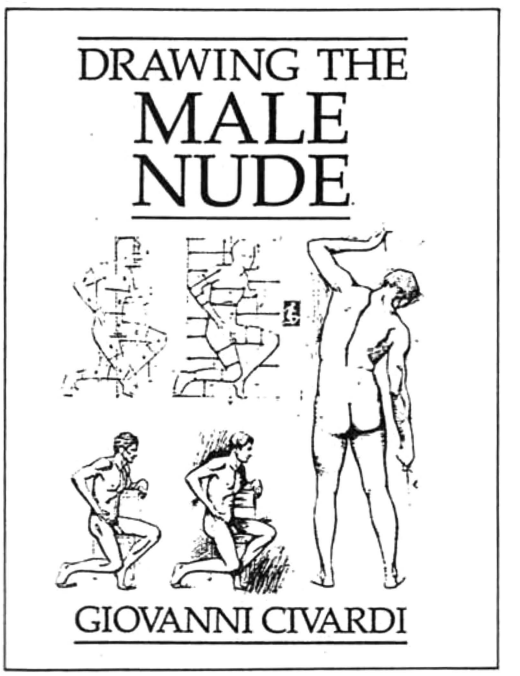
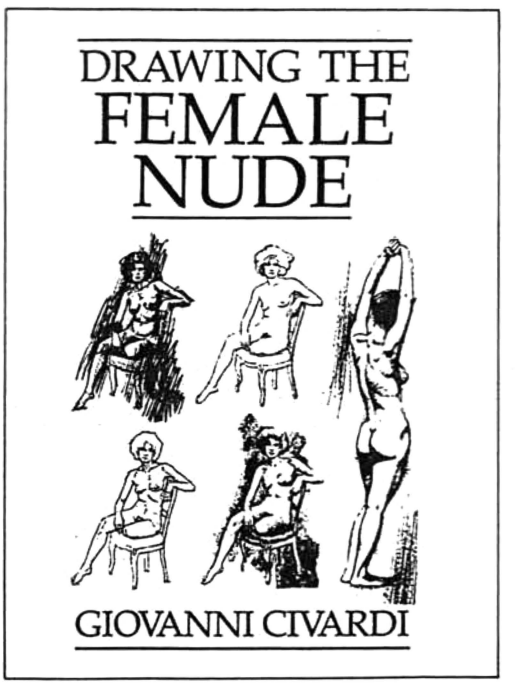
GIOVANNI CIVARDI is an Italian artist and teacher who for some years has combined studies at the Faculty of Medicine, Milan, with the practice and teaching of sculpture, drawing and illustration. He is the author of a number of practical art instruction books.

Other Studio Vista titles by Giovanni Civardi:
Drawing the Male Nude
Drawing the Female Nude





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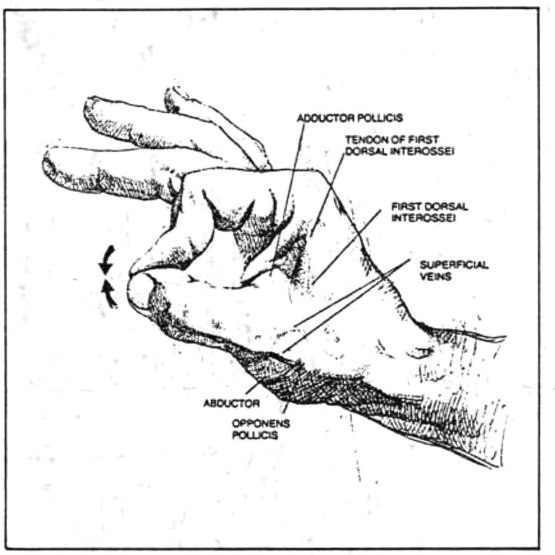

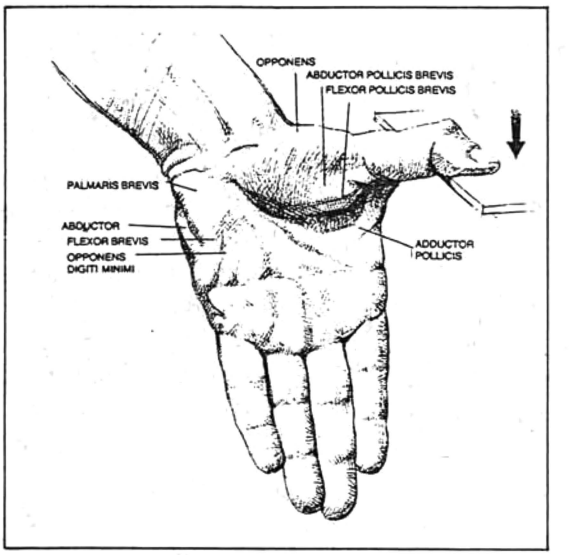

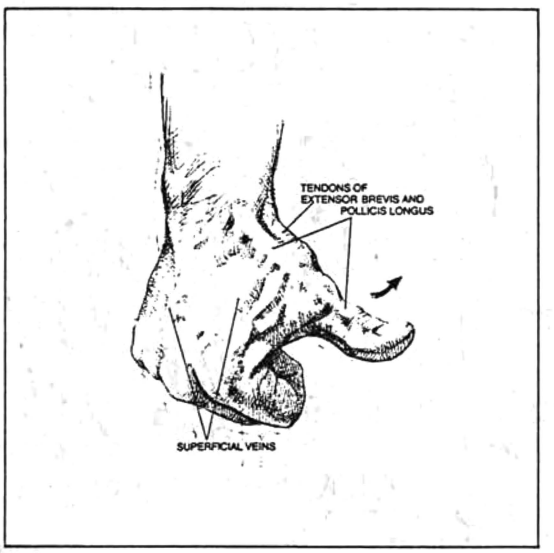

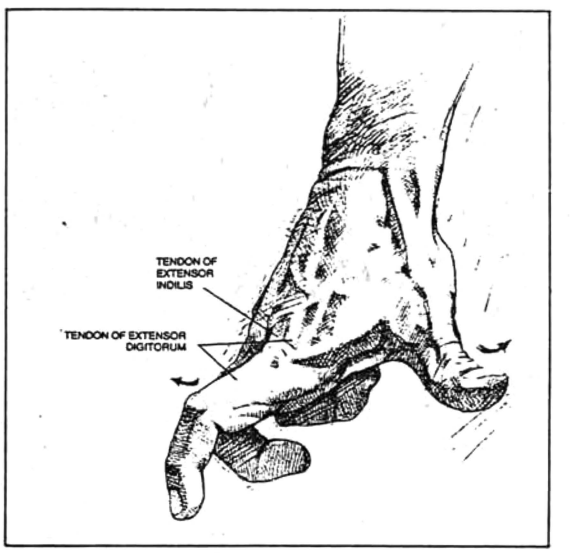

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